C. C. N. S. SERIES

HOW TO STUDY GEOGRAPHY.

FRANCIS W. PARKER.

R. L. Brown

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BY

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PREPARED FOR THE PROFESSIONAL TRAINING CLASS OF THE COOK COUNTY NORMAL SCHOOL.

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INDEX.

PREFACE.

In beginning this book I proposed to write a pamphlet of one hundred pages, more or less, for the use of the teachers of the C. C. N. S., but the work grew to its present size, and I am obliged to allow some faults in type and arrangement to remain. The book has been written in the odds and ends of a busy schoolmaster's time. There is, no doubt, much in it for friends to criticise adversely and much that needs the sharp lance of others not so friendly. *I dedicate the book to all teachers who thoughtfully and thoroughly prepare every lesson.*

Francis W. Parker.

INTRODUCTION.

Motive.—There is but one question in this world: How to make man better; and but one answer: Education. Education presents the conditions for man's complete development. To find the highest law of human life is the central problem in the philosophy of education; that law which determines the highest function of a human being. The central problem in the art of education is to train and develop that function in each and every human being; and as an essential sequence, the development of each and every power of mind and soul. Man was made for man, and his one God-like function is to take knowledge from the eternity of truth and put it into the eternity of human life. There is a perfect reconciliation between the application of unlimited altruism and the most complete education of the being who holds and fully applies it: for the knowledge of the needs of man, and the human acts which supply those needs, are in turn the essential means of the all-sided development of each human being. It is self-evident that the knowledge of the needs of man embraces all knowledge, and the application of that knowledge all proper human activities.

The explanation of human life, then, is that *it gives*, and just in proportion to the value of that which it gives *it grows*.

All we have to know is the needs of mankind; all we have to do is to supply those needs.

True education concentrates upon the development of the highest motive.

Upon this basis, the absolute and relative value of any branch of knowledge, the fundamental reasons for its teaching, the proportion of time and effort given to it, must be determined by the influence of such knowledge upon the outworking of God's design of the human being into character.

The knowledge of life comprehends all knowledge, and therefore the study of life comprehends all studies. Inorganic or inanimate matter is the material basis of all animated organisms, and the purpose of the study of all the sciences that pertain to inorganic matter is to gain a knowledge of the preparation for life, its substantial basis, and the explanation of the laws and conditions of life. Life is in itself a unit of evolution from the lowest germ of the plant up to the highest development of human consciousness.

The study of any item or detail of life, or of the preparation for life, becomes of vast importance when we appreciate its relations to the grand totality of life. There are no trifles in real teaching; the child studying the root, stem, leaves, flowers and fruit of a plant is gaining essential elements in all knowledge. What he learns is organically related to all truth; through the life of a simple plant he may one day see something of the complete unity of life. This beautiful truth adds great dignity to to all real teaching and study.

All sciences, though isolated in name, are the organic factors of one great whole,—each is intrinsically related and bound to all; perfect knowledge of one means a perfect knowledge of all.

No science can be learned by itself. The true value of one science is found in its relations to the universal

whole. Botany, zoology and physiology find a common term in biology; biology is the basis and explanation of anthropology and ethnology. These sciences grow into philology, psychology and philosophy—all find their culmination in history. History is the record of human acts, and in this record are to be found the laws and rules of human conduct; that is, in the knowledge of ages of human actions, the principles of human growth and progress are discoverable. Any valuable knowledge of history is impossible unless the environment that educates or degrades is first understood.

Geography is the study of the material basis, the primary conditions and explanation of life and the substantial preparation for it. Structure and climate are the two halves of one great whole in which life has its roots, environment and material causation. Again, plant and brute life is one half of another whole, of which man's history forms the complementary and completing half. The structure, climate and inferior forms of life explain the life and growth of man up to the stage in which his enhanced intellectual and moral development enables him to turn upon nature and make it his instructor and servant. Geography gives us the key to both the degrading and elevating influences of structural and climatical environment, and, also, the limitations of this powerful agent.

One direct ethical outcome of this knowledge is to soften and restrain the otherwise harsh judgments dictated by the absolute rules of human conduct. "The quality of mercy" is a just sequence of a comprehension of the circumstances which make men what they are. We tolerate the low, base and degrading in human beings, who are made what they are by unfavorable natural environments without the elevating influences of right human teaching. On the other hand the same knowledge creates a great

reverence for the prolonged struggles to overcome the immense obtstacles which have been placed in man's pathway of progress.

Geography explains and illuminates history; by it, laws tendencies and motives are understood; through it we learn to be merciful in regard to human weaknesses, and to appreciate all efforts in the right direction. To know the world is to love the world: some comprehension of the causes and effects of truth and error, which are ever acting and reacting upon man, the perception that divine law and divine love moves in all and controls all, creates in the soul a truth ideal of life and living. To know and love the whole world is to become subjectively an integral factor in all human life; the resulting emotion arouses the only true patriotism, the patriotism that makes the world and all its children one's own land and nation. Geography is one essential means of bringing the individual soul to an appreciation of the universal and eternal.

The study of geography, elementary and scientific, cultivates, systematically, the faculty of imagination, and the products of this faculty arouse and develop at every step, emotions of beauty that culminate in the emotion of grandeur. The mentally pictured hill is "a thing of beauty," which, in time, towers up into the grand image of the lofty mountain. The lake is the inception of a picture of "old ocean's solitary waste." Gradually, under skillful teaching, hills, mountains and plains, oceans and continents are united in one sublime image of the round world. Life-bearing and life-giving it stands out before the exalted imagination. No one can study real geography without a deeper reverence and higher adoration of Him whose thought is expressed by the universe.

The greater includes the less, the highest law and the noblest motive co-ordinates, arranges and adapts all the

subordinate laws, expedient motives, and inferior uses which lie between the inception and the end. "Seek first the Kingdom of God and His righteousness and all things will be added unto you."

Thus the so-called practical uses of geography, knowledge of commerce, trade and the like, fall into their proper places and highest uses, just in that degree, in which the one motive of man's broadest development is kept in view, as the single aim of education.

To the teacher who stands facing even a glimmer of glory which the grandest law of human life and the noblest motive of human action reflects, comes the divine inspiration that leads her to turn eager faces of the children to the blessed light of truth.

THEORY. Geography is a description of the earth's surface, and its inhabitants. This good old-fashioned definition is thoroughly sound and true: it covers the whole ground. "And its inhabitants," includes anthropology, ethnology and history, sciences by themselves (if history may be called a science); therefore these sciences cannot be included in a scientific definition of geography, as a simple science, or a science in itself—not including other sciences.

A definition of geography pure and simple is "a description of the earth's surface." If we include in the definition the forces which act on and under the earth's surface —we enter the realm of physics, chemistry, geology and mineralogy. The discussion, then, of the theory of teaching geography, should be concentrated upon the description of the earth's surface.

The primary purpose of teaching geography is to develope in pupils minds a concept corresponding to the earth's surface. This states subjectively that which a de-

scription of the earth's surface presents objectively: the two statements are counterparts.

The psychological basis of a description is a mental picture or image. No one can describe the earth's surface, or any part of it without having a concept which corresponds to the surface described. These facts are very simple, their importance lies in the solemn truth that very much so-called geographical teaching consists of descriptions of the surfaces of maps which have (in pupils minds) no relation whatever to the reality.

Of what does the surface of the earth consist, or in other words what form or forms are to be described in teaching geography?

If the earth were a perfect sphere or spheroid, that is if its surface were perfectly smooth, a description of the earth's surface would be extremely simple, but the remembrance of localities would be extremly difficult indeed, well nigh impossible. Places could be located, only as they are upon the broad ocean, by latitude and longitude. The smooth surface would present no character, in it there would be no distinctive features to form anything like a clear mental picture; there would be nothing salient upon which the mind could fix.

A chaotic irregularity of surface would present the same difficulties of localization; for instance in the Bad Lands of the West, the broken surface presents great difficulties to travelers who try to thread the mazes of that chaotic formation.

The first beautiful truth that comes to the student of geography is that the surface of the whole earth is arranged in slopes, as an organism, not of life, but *for life.* The earth's surface is broken into long and wide inclined surfaces. These great slopes, meeting at their lower edges form the vast depressions, in which are held the oceans of

the globe. The same slopes meeting at their upper edges form the great upraised masses of land called the continents. Each continent consists of two slopes divided by an axis. The two slopes which form the continent are sub-divided in the Americas by secondary axes. According to a law of the mind, the first mental view of a continent. the first clear generalization must be of these broad all-embracing slopes. By the simplest and easiest act of the mind this triangular pyramidal solid is cognized. There is no confusion of details to obstruct the mental vision. The analysis of any primary slope reveals its extreme complexity ; broken into immense river basins by meeting slopes; the basins of the tributaries are formed in turn, by other slopes, so we can follow the complications of meeting slopes down to the basins of tiny brooks and still smaller inclinations whose meeting lines are not covered by running water. All these meeting slopes present the features we may call character in surface. Any two joined inclinations of surface, either at upper or lower edges, have a distinctive character, differentiated from all other surface features. It has an individual appearance, an appearance that rises in the consciousness when the name of a locality recalls it.

This character of surface is the essential, specific and indispensable basis of the remembrance of places and events; it makes possible the greatest economy of mental action. By it every event of history, past or present, ancient or modern, is instantly localized.

The association of an event (a march of armies, a new railroad, an impending revolution) with a distinct image of surface features fixes it in the memory forever. Nothing "schwebt in der Luft" the study of history becomes a living reality. Fixing events in space is the essential

means of fixing them in time and thus organizing a knowledge of history.

A clear image of any part of the world intensifies interest in all that happens there. The eye strikes, in the headlines of a newspaper article, the name of some place in which we have been, or the geography of which we have carefully studied, and we generally read the article with interest, barren though it may be in itself, because the pictures it arouses fill us with pleasing recollections and emotions. The concept of the broad outlines of a continent, with its joined slopes meeting the oceans at their lower edges, is the basis of all growing knowledge of the land surface.

Each modification of the outlined whole river basin, or plateau, as it is studied, falls into its place with the whole concept, becomes related to it and is explained by it. Gross errors in descriptions may thus be changed to truth in the same way.

A few years ago the English people, who only study the countries they conquer, believed that the Hindu Kush pushed its mighty wall westward so as to form an almost impenetrable obstruction between the Caspian Sea and the coveted Khyber Pass. A man on horseback rode easily across the supposed mountain wall, and dissipated that geographical fancy. The student who has a mental picture of the whole can easily modify it in accordance with the newly discovered fact. The most practical result of the study of geography is the clear concept of the outline—vertical and horizontal—of the whole continent.

The continents are the abodes of men, the vast oceans furnish the life blood of the firm land; the immense body of atmosphere that surrounds and incloses both water and land is the breath of the world, the means of interchange of moisture, or the life blood of the continents. But the

firm land, the ever moving waters, and their vast envelope would ever remain in lifeless stillness, in eternal death, were it not for the infinite energy imparted by the sun. Under the mighty influence of heat the waters of the oceans move in vast currents, rivers in the ocean; the atmosphere is filled with moisture by the same inexhaustible power; immense volumes of air sweep regularly from tropic to pole, bearing its precious freight of vapor to pour in life-giving rain upon the long slopes, which bear it through soil and in surface floods back to the ocean again—but not until it has done its marvelous work in covering the land when it falls with vegetable life. The distribution of heat depends upon the inclination of the axis and the rotation and revolution of the earth, but the use of the heat to the land in furnishing the conditions for the life of man, depends fundamentally upon the nature and arrangement of the inclined surfaces; here we get a glimpse of what is meant by organism for life.

The uses of slopes in the economy of world life may be summed up:

1. The character of joined slopes is the basis for the remembrance of all that has taken place on the land.

2. The inclined surfaces distribute the soil; physical forces crack off, break, abrade and grind up the solid rock; the sloping land distributes under the law of gravitation the ground up masses of soil over its surface. The upper parts of slopes are the store-houses of soil—material for all the surface below.

3. The amount of rainfall depends largely upon the height and arrangement of slopes.

4. The distribution of heat is modified by height.

5. Drainage depends entirely upon the arrangement of land surfaces in slopes. Water percolating through

soil down inclined surfaces gives rise to vegetation, and upon vegetable life animal life depends.

6. The upraised masses of land determine the coast lines.

A knowledge of structure (pure geography) is the indispensable foundation of all geographical knowledge; without this knowledge the science of geography is impossible.

The purpose of learning structural geography, it may be repeated, is the acquisition of a concept or mental picture which corresponds to the surface structure of the earth in general outlines and prominent features. Proceeding deductively, from the highest generalization downward, a knowledge of structural geography consists of:

1. Concept of the whole earth as a sphere.

2. Positions of the continents on the globe and their relations in position to the oceans.

3. Position of the oceans and their relations to the continents and islands.

4. General Structure of the Continents.

a. Great slopes.
b. Continental axis.
c. Land masses.
d. Secondary axis.
e. Great rivers basins.
f. River systems.
g. Coast lines.

5. Distribution of Heat.

a. Movements of the earth.
b. Inclination of axis.
c. Zones.
d. Distribution of heat, modified by height.

6. Mathematical Geography.
   1. Latitude.
   2. Longitude.
   3. Time.

7. Ocean Currents.
   a. Cause.
   b. Effects upon Atmosphere.
   c. Upon Distribution of heat.

8. Atmosphere.
   a. Movements.
   b. Causes.
   c. Regular winds.
   d. Distribution of moisture.
   e. Condensation.
   f. Rainfall.
   g. Effect of winds upon distribution of heat.

9. Distribution of Soil.
10. Distribution of Vegetation.
11. Distribution of Animals.
12. Distribution of Races of Men.

A concept of the earth with all these factors organically arranged and related is the basis of political geography. The prevailing mode of teaching geography makes this department of the subject, the central and nearly the sole aim of the school work. What does a pupil study when he divides up the continents into political divisions, without a concept of the structural basis? The answer is not far to seek; he studies a map without the slightest relation to the continents themselves.

With the concepts, above outlined, political geography is the division of the (to him) real earth into its artificial regions by natural boundaries. The work under these

conditions becomes plain, simple and even beautiful. A map of the world, before him on the blackboard, is full of meaning, and glowing with life.

The crayon as it shows the boundary of a political division, shows, also, the relation of that division, structurally, to the whole world. He can describe the structure of the divisions, he knows its soil, climate, vegetation, animals, races of men, and is fully ready to study the structure particularly, to know more of its vegetable products, animal life, races, and to begin the study of its history. This is true of all political divisions, what he thus learns, every new detail enters into an organic body of knowledge; there is no isolation, no need of cramming ; the memory grows as the mind grows. That which he learns cannot be forgotten.

He enters upon the study of each division with renewed emotions of pleasure.

To illustrate, a structural map of Asia is before the pupils; the subject of study is India. With the basis above outlined already in their minds, the pupil can readily see,

1. India is a part of Eurasia.
2. It is a part of the short slope of Eurasia.
3. It is one of the six great peninsulas on the short slope.
4. The horizontal form of the peninsula is triangular.
5. It is enclosed by the Indian Ocean, the Plateau of Iran, the Himalaya mountains and the mountains that form the upper part of left slope of the Brahmaputra.

Structurally it is divided into two distinct regions; the Plateau of Deccan and the plain formed by the basins of the Indus, Ganges and Brahmaputta. This briefly indicates only a small part of that which pupils will know of one political division. A few weeks, well

spent in studying political geography, after the foundation is laid, will give pupils an excellent general knowledge of all political divisions.

Geography is the open door to all the sciences.—The day is slowly coming when all the elementary sciences with history and literature will be essential factors in teaching from the beginning to the end of the common school course. Wise and thoughtful teachers will, after due deliberation, drop some of the isolated spelling, technical grammar, and figure reckoning to make room for the direct study of life and the preparation for life. It will be gradually discovered that reading, spelling, grammar, numbers, drawing can be best taught as immediate aids to the study of the thoughts of God in nature.

The science of geography is the real inception, the true beginning of the study of all the natural sciences. The knowledge of structure leads directly to the study of the history of the construction of the earth, geology: mineralogy, and its kindred sciences are involved in geology. Trained observation of the effects of force in any direction, of erosion, moving air and water, or the vitalizing energies of heat makes the study of physics a necessity. The more subtile changes in organic and inorganic matter open the wonders of chemistry, the percolation of water through the soil, giving life, as it goes, to plants, carries the learner directly to the study of botany. It is but a step from the study of plants to the study of animals, and to the highest animal, man. Thus the knowledge of the material basis of life is not only the elementary study of all life, but it unites all the natural sciences—makes them one grand unit.

The method.—The activities of the human being may be described. 1. The unconscious activities; physical activities not under direct control of the will. 2.

The sub-conscious activities, the brain activities that prepare ideas by a process of mentation for consciousness. 3. Conscious activities. 4. Automatic activities; those activities which after passing repeatedly through states of consciousness—are released by repetitions from direct volition education presents conditions that arouse and direct all these activities to the end, that the human being may be developed into the greatest possible use to his fellow men.

Teaching has to do with the conscious activities; it may be defined as the presentation of those conditions which arouse, sustain, intensify and concentrate conscious activities which directly induce growth and development.

The definition of teaching includes the definition of method. The method of teaching a subject or branch of knowledge consists:

1. In the arrangement cf the details or particulars of the branch in that order and manner best adapted to the development of the mind; it follows necessarily that the order and arrangement best adapted to the mind's action and growth is also the best for the acquisition of knowledge. This arrangement of details is called a course of study.

2. The presentation of the details in time, and stage of growth, so as to use the conscious activities in the most economical way; or, in other words, the adaptations of the subjects and objects of thought to conscious activities in such a manner as to concentrate all the powers of the being upon them.

The human being acquires knowledge and power by the action of immutable laws; no matter what external conditions may be presented to the teacher, the mind grows and acquires knowledge in its own unchangeable way, following undeviatingly its own divine laws. The presentation of conditions not adapted to the laws of the mind, in

its stage of growth, *obstructs mental action and wastes energies.* The mind may grow, however, in spite of obstructions, but the growth will be natural, according to natural laws.

In order to understand a method a teacher must know the laws of mental development and the means (subjects and objects of thought) of the development; under this knowledge the method (adaptation of means to development) may be studied.

In teaching any arbitrary adherence to an order of time, regardless of the order of growth, is fatal to development. Any teacher who pretends to have a perfect method of teaching any subject is a quack. Perfection in method is a pure ideal, far beyond the reach of present knowledge. The course of study here presented is divided into two distinct parts, namely, the elementary and the scientific. The purpose of the elementary part of the course is the collection by observation, investigation, reading, hearing language, and study of the psychic material indispensable to the inbuilding of an organic body of truth in the scientific course. The elementary course is suggested for the first four grades. The process of thought in these grades is mainly inductive. The mental powers to be constantly exercised are those of synthesis and analysis—the later used at all times to enhance the strength of the former. Color, form and number are the essential factors of synthetic power.

Observation, hearing, language and reading are the three mental processes conditioning the presence of objects and symbols.

Curiosity and fancy are the innate tendencies to be used by skillful teachers, in making fleeting impulses steady and constant.

Lastly, to intensify, enhance, concentrate and compact

all the conscious activities, are the various modes of expression: making, modeling, painting, drawing, oral and written language. The agents of teaching just named are common to all teaching. The choice of subjects and objects of thought makes the method of teaching geography distinct from the teaching of all other branches. The main purpose of scientific geography is to build by the faculty of imagination the mental pictures of the continents and then to synthetize them into an image of the round world. The principal work, then, in the primary grades, is to collect sense-products needed for work of the grammar grades. Field lessons, observations and investigations, that develop these ideas, should form the essential part of the course. This work has been outlined in the course of study and in the "notes." The architect who designs one part of an edifice must know its relations to the whole; so the teachers in the lower grades should know the purpose and end of every subject and object of thought.

A science is one organic whole of truth, at each step each inference and generalization involve all preceding knowledge; each science, in turn, is only a part of one great science, the science of life and living. Scientific geography illustrates this great truth in a beautiful way. The study of one continent requires all the most careful teaching the lower grades can furnish; one continent is the measure of another, and so on; the last generalization in the study of civilization demands for its thorough exposition every fact, inference and generalization that precedes it. To the teacher who watches with great eagerness and insight the growth of her pupils in geography never need to hesitate in regard to the new conditions that should be immediately presented.

It may be argued against the arrangement of subjects presented in the course of study that there is not enough

of political geography in the six grades from the lowest up; that pupils who leave school in these grades will not have as much knowledge for practical use as they would if political geography were the principal aim of the work. Several answers may be made to this apparently important objection. The study of history which should run parallel with the geography will supply pupils with all the information upon political geography that they are capable of understanding.

Difficulties.—Children have very clear mental pictures of the houses in which they live and of the scenery that surrounds them. These objects they can easily describe from their mental images. It is easy to lead them to imagine scenes and landscapes that lie beyond their sense-grasp by the relation of stories. The novelist understands this power to picture scenery, he places his readers in mountains, valleys and plains at will; landscapes are made clear and often vivid.

The modern historian, like Curtius, takes his readers into Greece, and they travel with him over the hills, mountains, and valleys of that wonderful penisula.

The task of the teacher of geography is precisely the same in kind; the inference in theory at least, seems a safe one, that what the novelist and historian can do, can also be done by the skillful teacher, that the great, simple outlines of continental structure can be made as clear to pupils—as a mountain ridge in Italy, Greece or Palestine.

This, seemingly simple, plain and practicable theory is met and opposed by the facts of long experience; the application of the theory has not often met with the desired results.

Careful examinations, prove that very few pupils after years of study, have acquired the elementary and substancial basis for the study of history, the power to think the

world as a whole, differentiated by the simple analysis, into upraised forms, and inclined surfaces.

Arguing from such and similar tests, many a teacher might conclude that the theory is wrong, that it is not adapted to the mental powers of children.

Failure in application of a theory does not always prove that the theory is false; there have been countless failures in the application of the Golden Rule, or in the principles of temperance, yet no one dares to deny the truth of the theories. The question is, does the difficulty lie in a false theory or is it to be found in the unskillful application of a true theory? The inclination is a very strong one to believe that the difficulty is in unscientific teaching and not in the mental powers of children.

A great number of careful and prolonged examinations of candidates for teacher's positions, coming as graduates from high schools and colleges, show conclusively that anything like a fundamental knowledge of geography, after long years of study, is the exception and not the rule.

Teachers cannot teach that which they do not know, Jacotot to the contrary notwithstanding. If teachers know little else but mental pictures of maps and an isolated mass of conglomerated facts *they cannot teach geography.* The habit of thinking of the map and the map alone is an almost insurmountable obstruction in the way of a teacher's ever learning to teach real geography. A teacher who has always taught figures and fancies them numbers, rarely learns what a number really is. The main difficulty in the way of the application of the science of teaching is the ignorance, on the part of teachers, of the subjects they pretend to teach. Habit and tradition stands in the way of their ever learning these subjects. It costs very little to deny that a plan or method

is right; it costs long years of patient, persevering toil to grapple anew with a subject which has been thoroughly misunderstood. The cheap way is the common way, and children must suffer the terrible consequences.

The application of the true principles of geographical teaching will cost every teacher who has studied maps instead of the earth's surface courageous and devoted enough to try it, long years of the closest study, but the children who are properly taught from the beginning will one day teach geography as Agassiz taught natural history.

The plan here presented is given to teachers with a profound faith that they and their successors will find something far better for the children.

HOW TO STUDY GEOGRAPHY.

RIVER BASINS.

The following diagrams, statements and problems are given to aid teachers in forming a concept of all the general conditions of a river basin. By general conditions is meant the prominent features, *i. e.*, those which enter into all river basins.

1.—Two Conditions of a River Basin.

I.—Two inclined planes, surfaces or slopes, meeting at their lower edges.

Note.—These diagrams present the geometrical or conventional conditions, and not the real form of a river basin.

A

Put a pin into water parting *a*, one at *b*, and one at *c;* stretch a line between the pins and we would have a line like *a b* and *b c*.

II.—*a b* and *b c* represent any two transverse lines in the two planes, surfaces or slopes of a river basin.

III.—*a* is *any* point in the altitude of the left slope (left of river looking down the river), *i. e.*, in the water parting.

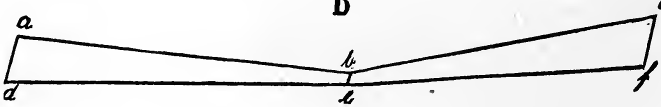
IV.—*c* is any point in the altitude of the right slope

V.—*b* is any point in the line formed by the meeting of the two slopes at their lower edges.

NOTE.—The river *always* flows over this line.

VI.—*a b c* represents any line drawn transversely across river basin from water parting to water parting.

B



2.

I.—*b* represents conventionally any cross section of a river basin cut from the surface down to the plane of the mouth of river, or plane of body of water into which the river flows.

II.—*d f* is any line in the plane of the surface of the water at the mouth of the river, or the surface of the body of water into which the river flows.

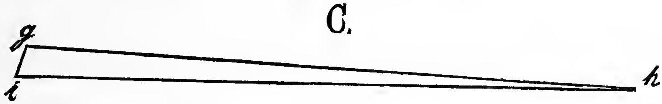
PROBLEMS.—1. What is *a d* ?
2. What is *c f* ?
3. What is *b e* ?
4. What is *a b e d*?
5. What is *b c f e* ?

Why does the river always flow over the line of which *b* is a point?

When this line changes, the course of the river must change.. Why?

3.—Lateral Section of River Basin.

C.



I.—*g h* represents the line of which *b* in *A* and *B* represents a point.

NOTE.—*g h* represents the line of the meeting of the two slopes which form the river basin at their lower edges. The water or river *always* flows over this line. Land may rise from, and above the river bed, then there would be two slopes within the two slopes that form the river basin (an island), and consequently there would be two lines which bound the two slopes that rise above the river bed.

D.

II.—*i h*, in *C*, is a line in plane of the surface of the body of water into which the river flows. If the

river flows into another river, *i h* is in the plane of surface exactly at the mouth of the river.

III.—*g i* is a line representing the altitude of the slope *g h*.

g is a point in the altitude of the source or general slope of the river basin.

h represents a point at the mouth of the river or lowest point of the source or general slope.

IV. PROBLEMS.—1. When does *b e*, in *B*, coincide with *g i*, in *C*?

2. At what point is *b*, in *B*, in the same plane with *d f*, in *B*, and *i h*, in *C*?

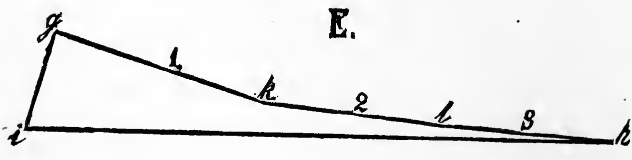
3. What does the length of *i h*, in *C*, determine? Is the river always as long as *i h*, in *C*?

4. Why? Why not?

5. What does the grade of the general inclination of *g h*, in *C* determine?

6. If *g h* were at a right angle with *g i*, what would be the result?

E.



4.

I.—In *E*, *g h* is divided into three grades of slope or inclination, to-wit: (1) *g k*, greatest inclination; (2) *k l*, less inclination; (3) *l h*, the least inclination.

NOTE.—Most rivers, especially large river beds, have these three grades of slope; the grades are by no means regular (having the same lengths); in some river beds the order of grades is reversed.

PROBLEMS.—What effect would each of these three grades have upon a river?

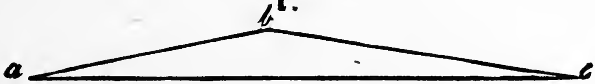
If *g h*, at any portion of its inclination were nearly parallel with *g i*, what would be the result?

5.—Natural Lines or Lines Which Bound (Inclose) Natural Divisions.

I.—There are three kinds of natural lines formed by meeting surfaces. These lines divide and bound natural divisions of continental surfaces.

1. Lines formed by the meeting of land surfaces or slopes at their upper edges.

F.



II.—*b* is a point in the line of meeting of two slopes at their upper edges. The line of which *b* in *F* represents a point, divides two slopes.

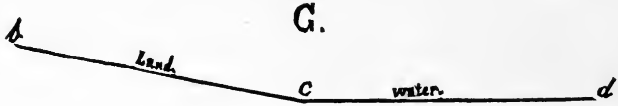
NOTE.—In the West such a line is called a "divide."

2. Lines formed by slopes meeting at their lower edges, as *b* in *A*. All *naturally* moving surface water

flows over these lines. There are many such lines upon land surfaces *over* which no water flows. Why?

3. Lines formed by the meeting of land surfaces or slopes with water surfaces.

G.



I.—*C* represents a point in the line of a land surface meeting a water surface (coast line).

NOTE.—There are other lines not natural, but in some degree arbitrary, which bound land surfaces; the most important in the study of structure is the line which divides highlands and lowlands at the height above ocean level of 1,000 feet (Guyot). This line is not formed by meeting slopes, but it divides a slope laterally. There are also snow lines, timber lines, etc.

PROBLEMS.—*a* and *c* in *B*, and *g* in *C*, are points in a line. What line? *h* in *C* is a point in the same line as *a c* in *B*, and *g* in *C*. What line?

Bound a river basin? A boundary should entirely inclose the space bounded. Bound the left slope of a river basin.

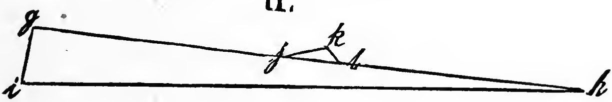
6.—Change of Natural Lines.

Natural lines (three kinds) are *constantly changing.* It may be said that they change every day, if not every hour. Slopes grow less or greater in breadth. Rivers change their channels in some part of their course.

The study of the causes and effects of these constant, everlasting changes is *exceedingly interesting* and instructive.

What causes natural lines to change? Name all the causes. What are the results of these changes? Name them all.

H.



g h represents the line of meeting of the two slopes that form the river basin, and it also represents by its inclination the source or general slope of the river basin. This slope *g h* meets at *j* an opposing slope, *j k*. What is the result? What in the river would the opposing slope *k l* form? How could the opposing slope be naturally removed? How the opposing slope be changed to the inclination of the general without removal?

NOTE.—Such formations as indicated in *H* (opposing slopes) are common to many rivers; probably all rivers in the beginning of their growth had many such opposing slopes. The St. Lawrence basin is the most remarkable example of this kind.

NOTE.—Upon changes in natural lines or natural boundaries of natural divisions of land surface, these lines change (1) vertically down and up—down by

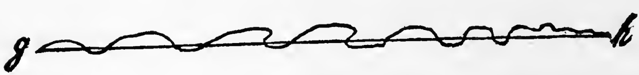
erosion and up by the filling up with abraded rock, and by volcanic action; (2) from right to left and the reverse by erosion and filling up with abraded rock or silt.

It is said by geologists that the Rocky Mountains were once a mile higher than they are now. What forces broke off and ground up the rock? Where is the ground-up rock now?

How does a river make its bed and cut its channel? What is a cañon? How is it formed?

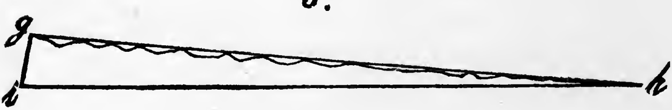
The line *g h*, in *C*, representing the line formed by the meeting of two slopes, is generally a *very irregular* line; it is never a straight line. What would be the result if it were a straight line?

I.



Horizontal view, movement from right to left, windings or meandering.

J.



Vertical view, movement up and down.

7.—The Frame Work and Covering of River Basins.

The frame work of a river basin (there may be exceptions) is a solid mass of rock. This mass of rock is nearly, and in some instances wholly, covered with soil or ground-up rock (gravel, sand, clay, marl, loam, vegetable mold, etc.). The soil is of varying depths, from a few inches to hundreds of feet.

What would be the result if there were no soil or ground-up rock on the hard rock skeleton? By what means was the soil spread out over the rocky skeleton?

What and where can you see the same forces acting now?

Show how a river cuts soil and rock down?

Show how the bed of a river can be raised?

How does a river move from right to left and the reverse?

What are the results?

What effect has the revolution of the earth upon rivers which flow south or north?

8.—Storage or Natural Reservoirs of Water in River Basins.

I.—There are four means of water storage in a river basin.

1. Surface water like springs, ponds, lakes, tributaries, the river itself.

2. Ice and snow upon great heights.

3. Underground reservoirs in clefts of rocks, caves and channels under the surface.

4. The soil through which water soaks or percolates.

Which kind of reservoir generally furnishes the greatest supply of water to the river? Which generally holds the most water at any one time, the surface waters or the soil?

Explain the causes of a freshet or a flood.

What has vegetation to do with holding moisture?

How are rivers artificially supplied with water, generally for manufacturing purposes?

What is a canal, and how is it made?

When is the valley or lower part of a river basin irrigated?

How is land irrigated by ditches or canals?

What is an artesian well, and how is it made?

Upon what two general conditions does the amount of water in a river depend?

In some very large river basins comparatively small areas furnish most of the water for the river. How do you account for this fact? See Nile basin.

How are swamps, morasses formed?

9.—Uses of Rivers.

How large an area of land does a river drain?

Exception. Several correct answers can be given to this question.

Give all the uses of a river basin? What is the most important use?

What are the uses of a river? Find as many as you can.

What are the two principal uses of a river?

What would be the conditions of a straight river? There are no rivers of this kind.

What would be the effects of a straight river?

Why does a river wind? What are the uses of the windings?

What part of a river is generally navigable, if it be navigable at all?

What are the surface conditions of rivers used for manufacturing?

10.—Classification of River Basins.

From general conditions peculiar to all river basins, we take up the size and particular features belonging to individual river basins.

I.—Areas in square miles.

		SQUARE MILES.
1.	Amazon	2,681,000
2.	Obe	1,360,000
3.	La Plata	1,250,000
4.	Mississippi	1,237,000

		SQUARE MILES.
5.	Nile	1,167,000
6.	Amoor	1,063,000
7.	Yenisei	999,000
8.	Lena	775,000
9.	Hoang Ho	714,000
10.	Volga	637,820

II.—Lengths of rivers.

		MILES.
1.	Mississippi	4,396
2.	Nile	3,895
3.	Yenisei	3,688
4.	Amazon	3,596
5.	Missouri	3,096
6.	Niger	2,990
7.	Hoang Ho	2,812
8.	Lena	2,766
9.	Amoor	2,673
10.	La Plata	2,500

III.—Large rivers that have their sources in primary highlands and flow at nearly right angles with primary axis—Amazon, Indus, etc.

IV. Large rivers which flow nearly parallel to primary axis; the upper part of one slope is formed by primary highlands—Mississippi, La Plata.

V.—Large rivers whose right and left slopes are plains—Yenisei, etc.

VI.—Large rivers that break through high mountain masses and plateaus.

VII.—Pairs of rivers; rivers flowing in pairs through the same plains:

Hoang Ho and Yang-tse Kiang.

Indus and Ganges.

Tigris and Euphrates.

VIII.—Large rivers, that flow toward the continental axis—Volga, etc.

Comparison of river basins—

Mississippi with La Plata.

Amazon with St. Lawrence.

Colorado with Zambesi.

Magdalena with Danube.

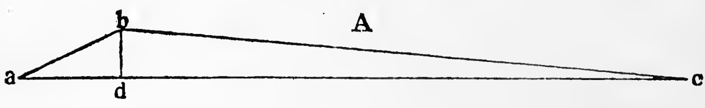
What large rivers have no great heights of land in their basins?

STRUCTURE OF THE CONTINENTS.

NORTH AMERICA.

North America is an immense mass of rock projecting above the ocean level. Viewed transversely this mass of rock (5,700 miles long, and at the broadest 3,000 miles,) is in shape a triangular prism.

FIRST STEP.



A represents any transverse section of North America throughout its entire length, 5,700 miles.

a c represents a line in the plane of the base of this triangular mass of rock, or in the plane of the ocean level.

b represents a point in the line which extends from

north to south through the entire continent. It divides the continent into two great slopes. This line is formed by the meeting, at their upper edges, of the two great slopes which form the surface of North America. This line, in its relations to the whole continent, is called the continental axis.

b c is any line in the plane or surface of the slope which extends east from the continental axis to the Atlantic ocean. This inclined surface is called the long slope of North America.

Describe the general features of this slope.

a b is a line in the plane or surface of the slope which extends west from the continental axis to the Pacific ocean. It is called the short slope of North America.

Describe the general features of the short slope.

Compare the short slope with the long slope in length, area, drainage and general structure.

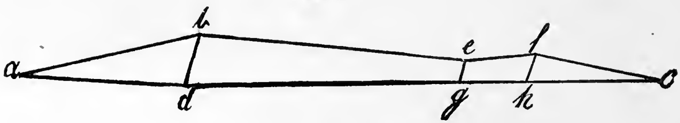
b d represents any altitude of the continental axis.

c and *a* are points in the coast line of North America; *c* coast line of the Atlantic; *a* coast line of the Pacific.

NOTE.—This division by the continental axis is the simplest analysis of North America; it is the basis of all succeeding analyses.

SECOND STEP.

B.



a c represents any line in the plane of the base of the continent (ocean level).

a b a line in plane of short slope.

b c a line in plane of long slope.

e f represents a line in the plane of a short slope *in* the long slope and opposed to the general inclination of that slope.

e represents a point in the line of the meeting, at their lower edges, of the two slopes; the long slope and the slope opposed to the long slope. This line may be traced from the mouth of the Mississippi to the mouth of the Mackenzie—somewhat broken or interrupted by the depression that forms the Winnipeg basin.

The Mississippi and Mackenzie rivers flow over this line with the exception of that part of the line which crosses the Winnipeg basin.

The line of which *e* is a point divides North America into two great land masses, (1) primary land mass; (2) secondary land mass. The primary land mass is one continuous, unbroken land mass from the

Isthmus of Panama to Bering strait; the secondary land mass is separated into two parts (northern and southern) by the St. Lawrence river basin (the Labrador land mass and the Appalachian land mass).

Each land mass (primary and secondary) is divided into two slopes; the primary mass by the continental axis (*b*), which may be called in its relations to the primary land mass, the primary axis. The secondary land mass by a line of which *f* is a point; this line is the secondary axis.

Bound North America.

All boundaries should be by natural lines.

Bound the long slope; the short slope. Bound the primary land mass; the secondary land mass. What is the length and width of each land mass?

Bound the slope in which *b e* is a line. Bound the slope in which *e f* is a line. Northern part. Southern part. Bound the depression in which *b e* and *e f* are lines.

What is the line *e g*? *f h*?

Where in North America does the point *e* coincide with plane in which *a c* is a line?

Note.—The mental use of bounding is to make clearer the concept or mental picture. Any attempt to bound from memorized words *is worse than useless.* Always try to bound without a map or molded form, and refer to the map only when the concept is not clear.

Compare slope *f c* with slope *a b*. Slope *b e* with

slope *e f*. Slope *a b* with slope *b e*. *e f* with *a b*.

Compare the primary with the secondary land mass. Describe the upper parts of the two land masses (mountain systems). Compare the mountain system of the primary mass with the mountain system of the secondary mass. Compare the northern and southern divisions of the secondary land mass.

THIRD STEP.

Drainage and River Basins.—Long Slope.

Mississippi River Basin.

Bound; (natural lines).

Parts of what two slopes form the basin?

What forms the source slope? *

What is the altitude of the source slope? 1,600 ft.

Where does the boundary (water-parting) coincide with the primary axis? With the secondary axis? Where does the water-parting separate comparatively low slopes?

Compare the right slope with the left slope (right

* The source slope is the general inclination of the line intersecting the two slopes, from the water-parting nearest the source to the mouth of river.

slope on right of river going down). What great river basins are there in the right slope? Bound each. What great river basin is there in the left slope? Bound. Compare the basin of the largest river in the right slope with the basin of the largest river in the left slope. What mountains are wholly within the Mississippi river basin? Between what two points would a ship canal connect the mouth of the St. Lawrence with the mouth of the Mississippi? How deep at the deepest must such a canal be?

What other river basins does the water parting of the Mississippi basin partially bound?

Mackenzie River Basin.

Bound. What two slopes form the basin? Where and to what extent does the water-parting coincide with the primary axis? How are the lakes in this basin formed? What effect does the frozen mouth of the river have upon the lakes?

Compare the Mackenzie basin with the Mississippi basin. What natural lines are common to both of them?

St. Lawrence Basin.

Bound. Describe right slope. Left slope. Over what highlands does the water-parting run? Over what lowlands? Account for the formation of the

great lakes. By what natural processes are these lakes changing to a river, *i. e.*, becoming a part of the river St. Lawrence? Were the Winnipeg basin to pour its waters into Lake Superior, what would the result be upon the lakes?

Compare Mississippi basin with Mackenzie basin.

Hudson Bay Basin.

Bound. Of what other basins does the water parting form a partial boundary? What are the principal rivers included in the Hudson bay basin?

Compare Mackenzie basin with St. Lawrence basin. Hudson Bay basin with the St. Lawrence basin.

In comparing, first see resemblances, then differences.

Atlantic System of River Basins.

Note.—By "system of basins" is meant a number of united river basins which form one slope and which are drained into one body of water.

Bound the southern part (Appalachian slope). What are the principal river basins in this system? By what bays is the slope indented? Describe the tide water region. How is this region *now* in process of formation? Compare that part of the Atlantic slope which includes the tide water region with that

part of the slope north of it (up to the St. Lawrence basin). What are the differences in the coast line, *i. e.*, between the coast line of the tide water region and the coast line north of it? What river basins separate the highlands of this system?

How are the harbors formed in the tide-water region?

Bound the Labrador system, *i. e.*, northern portion of the Atlantic system. Compare with Atlantic slope south of the St. Lawrence basin.

Alabama System of River Basins.

Bound. What river basins are included in this system?

This system is really a prolongation of the Atlantic slope.

Peninsula of Florida (not the State).

Bound. To what does Florida owe its structure? How does it differ from all other surface features of North America? By what rivers is it drained?

Texas System of River Basins (including Mexican Slope).

Bound. What river basins does it contain? Where and to what extent does its water parting coincide with the primary axis?

Bound the basin of the Rio Grande.

Compare the Texan system with the Alabama system; with the Altantic system.

Pacific System of River Basins.

Bound. What river basins form this slope? Bound and describe the Yukon basin; the Columbia basin; the Colorado basin; the Sacramento and San Joaquin basins. Compare the Columbia basin with the Colorado basin. In what do the Yukon, Columbia and Colorado basins resemble each other? In what do these basins differ from all other river basins in North America?

Bound and describe enclosed basin. Compare the Pacific system of river basins with the Atlantic system.

Compare the coast of the Pacific slope with the coast of the Atlantic slope. Compare the upper parts (highlands) of the two slopes.

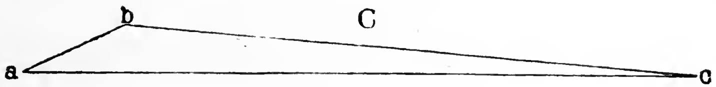
Describe the coast line of North America. Where and to what extent are the wearing coasts? The building coasts? Whence comes the silt (abraded rock) to build the tide water region?

What parts of the coast line are determined by highlands? What by frozen soil? What by other causes?

Describe the structure of North America *very carefully* by the mental picture you have gained in this study.

SOUTH AMERICA.

FIRST STEP.



Like North America, South America is an immense triangular prism.

From the analysis of North America the student can in the same way analyze this continent.

D is a transverse section of the triangular prism.

b represents a point in the continental axis which separates the continent into two slopes—a long slope and a short or Pacific slope.

What is *a c?*

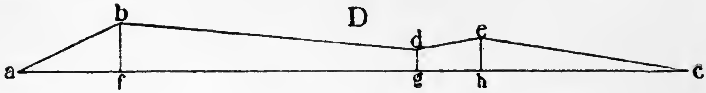
What is *a b?* *b c?*

Compare the long slope of South America with the long slope of North America.

Compare the short slopes of the two continents.

The line of which *b* is a point is one continuous line embracing the continental axes of the two continents; they form indeed but one axis.

SECOND STEP.



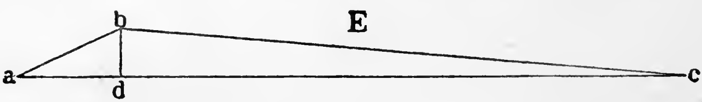
D represents a transverse section of South America across the Brazilian highlands.

b c a line in the long slope. This line in the long slope is met by a line in the opposing slope *d e*.

d is a point in the line of meeting at their lower edges of the two opposing slopes.

This line of which *d* is a point runs from the mouth of the La Plata to the mouth of the Orinoco, broken by the Amazon river basin. It divides like *e* in *B* the continent into land masses; a primary land mass and a secondary land mass.

The secondary land mass is divided into two distinct parts by the Amazon river basin; the northern part may be called the Guiana land mass; the southern the Brazilian land mass.



E represents a transverse section of South America; *b c* is a line in the plane of the long slope; it is, also, a line in the meeting of the two slopes which

form the Amazon river basin; *b c* in *D* is met by an opposing slope *d e;* in *b c* in *E* there is no opposing slope.

F is a transverse section of South America across the northern secondary land mass (Guiana).

Bound the primary land mass.

Compare it with the primary land mass of North America.

Bound the secondary land mass (southern part). Compare it with Appalachian land mass in North America. Bound the northern part of the secondary land mass (Guiana). Compare it with the Labrador land mass; compare it with the Appalachian land mass. Bound the slope *d e* in *D; e c* in *D; b d* in *D; b c* in *E; d e* in *F; e c* in *F.*

What is *b f* in *D?* *e h* in *D?*

THIRD STEP.

Analysis of Long Slope—River Basins.

Amazon River Basin.

Bound. Over what highlands does the water parting run? Lowlands? Bound the right slope. What river basins are included in the right slope? Bound the left slope. What river basins does it contain? How does this basin join the basin of the Orinoco? The basin of the La Plata?

Compare the basin of the Amazon with the basin of the St. Lawrence; the basin of the Mississippi.

La Plata River Basin.

Bound. Bound the right slope. Where and to what extent does the water parting coincide with the primary axis? Bound the left slope. Where and to what extent does the water parting coincide with the secondary axis? Over what kind of land (highlands or lowlands) does the remainder of the water parting run?

Compare the basin of the La Plata with that of the Amazon; with the Mississippi basin; with the Mackenzie basin.

Orinoco River Basin.

Bound. Bound the right slope. The left slope. Compare the right slope with the left slope. Compare the Orinoco basin with the Mackenzie basin; with the Mississippi basin; with the La Plata basin; with the Amazon basin.

FOURTH STEP.

River Basin Systems.

Brazilian System.

Bound. What river basins form this system? What line separates it from the La Plata basin? The Amazon basin?

Compare the Brazilian system with Appalachian system; with the Labrador system.

Guiana System.

Bound. What river basins form this slope or system? This slope is divided into three divisions, *i. e.*, the coast division; the middle division; the upper or

mountainous division. Compare the Guiana system with the Labrador system; with the Appalachian system; with the Brazilian system.

Patagonian System.

Bound. Principal river basins. What is the western boundary line? Compare with the Texan system; the Alabama system; the Guiana system; the Brazilian system.

The Maracaybo Basin.

Bound. Describe. Compare with the Hudson Bay basin.

The Magdalena Basin.

Bound. Describe. Compare with the Colorado basin; the Yukon basin; the Columbia basin.

THE SHORT SLOPE.

The Pacific System.

Bound. Give general description. What river basins form this slope? The rivers here are few and short. Why?

Compare with the Pacific system of North America. Give resemblances; differences. Compare coast lines. Compare mountain systems. Compare Brazilian system with Pacific system; Atlantic system of North America.

Comparison of the two Continents.

Resemblances, first; differences, second. Compare the two great masses of rock; area with area; length with length; breadth with breadth; outline with outline; projections; indentations; axes; slopes; river basins; river basin systems; mountain systems. Give ten marked resemblances; ten marked differences.

EURASIA.

In Eurasia, Europe and Asia are comprehended in one vast structure extending from Bering straits to straits of Gibraltar.

FIRST STEP.

H.

H represents any transverse section (north to south) of Eurasia.

Like North America and South America, Eurasia may be looked upon as an immense triangular prism.

a represents a point in the coast line of the Pacific, Indian ocean or the Mediterranean sea.

c a point in the Arctic or Atlantic ocean.

a c a line in the plane of the ocean level.

b represents a point in the natural line of the meeting at their upper edges of two vast slopes.

What is this line?

How long is it (approximately)?

Describe the northern or long slope.

Compare it with the long slope of North America. With long slope in South America. Compare it with the long slopes of North America and South America taken together.

Describe the upper part of the long slope of Eurasia. The lower part.

What part of this great surface inclines toward the continental axis?

Describe the short or southern slope.

Compare it with the short slope of North America? Short slope of South America. With both taken together. What features do you find in the short slope of Eurasia that are not found in the short slope of North America or South America?

Trace the continental axis the entire extent of the continent.

NOTE.—Eurasia is one great land mass. It is not divided into primary and secondary land masses as in North America and South America. In the latter continents the primary and secondary masses are divided by lines formed by long slopes meeting at their lower edges. The lower parts of these slopes are vast plains. It will be seen that no such conditions exist in Eurasia except the Scandinavian peninsula on the long slope and the Indian peninsula (the Deccan) on the short slope. The peninsulas of Italy and Spain are connected with the main highlands by mountain ranges.

SECOND STEP.

Analysis of Long Slope.

1.—Siberian River System.

Bound. What river basins are included in this system?

Bound the Lena river basin.

The Yenesei river basin. The Obi basin.

Describe the surface of the upper part of this system. The lower part. The middle or central part. Compare with Mississippi river basin.

2.—System of Northern Europe.

Bound. What river basins form this system? Describe the upper or highest part of this slope. The lower. The central. Compare with Siberian system. With Atlantic system in North America.

3.—The Enclosed Basin.*

This basin comprises the surface of plateaus and mountains that is not drained into the ocean. Bound. Describe. Compare with enclosed basin of North America.

*Not including Aral and Caspian basins.

4.—Great Depression of System of the Aral, Caspian and Black Seas.

Bound. Area. What land north of these seas slopes toward the continental axis?

Where does the boundary line run across highlands? Lowlands? Bound Aral system. Caspian system. Bound and describe the Volga river basin. Bound Black sea system. Compare this system (Aral, Caspian, Black sea system) with Mississippi basin. With Amazon, La Plata and Orinoco basins (taken together as one surface).

5.—Scandinavian Peninsula, Great Britain and Ireland.

Bound Scandinavian peninsula. Describe drainage. What connection may there have been between Scandinavian peninsula and Great Britain? Describe the structure of Great Britain. Of Ireland.

6.—The Danube River Basin.

Bound. Compare with Magdalena river basin in South America.

THIRD STEP.

Analysis of Short Slope.

Peninsulas and Plateaus.

1. Kamchatka.
2. Corea and Chinese peninsulas.
3. Malay.
4. Hindoostan, plateau of Deccan.
5. Plateau of Iran.
6. Plateau and peninsula of Arabia.
7. Asia Minor.
8. Greece.
9. Italy.
10. Spain.

Bound each. Describe. Describe drainage.

Compare the Deccan with Greece, with Italy, with Spain. Compare Kamchatka with Italy. The Malay peninsula with Spain.

River Basins.

1. Armur river basin.
2. Yang-tse, Kiang and Hoang Ho.
3. Cambodia.
4. Indus, Ganges and Brahmaputra.
5. Euphrates and Tigris.

6. Po.
7. Rhone.

Bound Basins. Compare Amur basin with Yukon and Columbia basins. Compare Yang-tse Kiang and Hoang Ho basins with Euphrates and Tigris; Indus and Ganges; Amazon; Mississippi. Compare the Ganges basin with Po; with Orinoco.

Continental Islands.

1. Japan Islands.
2. Philippine Islands.
3. Sumatra, Java and Borneo.
4. Ceylon.
5. Sicily.
6. Sardinia and Corsica.

Describe structure and drainage. Compare Japan with Great Britain; Ceylon with Sicily.

Indentations and Projections.

1. Lower edge of short slope.
2. Lower edge of long slope.

AFRICA.

I.

Transverse section of Southern Africa.

a c represents a line in plane of ocean level.

b a point in line of highest points or continental axis. *d* a point in a line of what may be called the secondary axis.

Africa is a vast plateau. The lack of long and broad slopes is the plain reason why it remains, for the greater part, in barbarism. Most of its civilization is found upon the short slopes—represented by *a b* and *d c*. Africa cannot be analyzed like other continents because it is not divided by natural lines that separate it into great natural divisions.

FIRST STEP.

1.—Basin of the Nile.

Bound. Area. How far does it flow through a rainless land? What would be the effect on Egypt if

the Nile were turned into the Red Sea above the cataracts? Compare the Nile basin with the Mississippi basin, the Amazon basin, the Volga basin. Describe the Nile basin.

2.—Barbary Slope.

Bound. Describe. What are the river basins which form this slope? Compare with Guiana slope, with Brazilian slope, with Appalachian slope.

3.—Gold Coast Slope.

Bound. Describe. Compare with Barbary slope; with Guiana slope; with Appalachian slope. What are the principal river basins?

4.—Desert of Sahara.

Bound. Describe. Describe oases; mountains. River basin or *Wady* systems. How can a part of the great desert be flooded by canal cut from the Mediterranean sea? Compare with the desert of Arabia; with the desert in the plateau of Iran.

5.—Soudan.

Note.—Soudan is a country of undetermined area, extending south of the desert and north of the Gold

Coast slope across the continent to the Nile basin.

Describe. Bound approximately. By what rivers is it drained?

6.—Southern Africa.

NOTE.—The peninsula-shaped country called Southern Africa may be bounded on the north by a line running across the continent east from the Bight of Biafia; it comprises a large part of the Nile basin; it is a vast plateau.

Describe. Describe the short slope from the continental axis to the Indian ocean. Describe the short slope from the secondary axis to the Atlantic ocean. The Zambesi basin, the Congo basin, the Orange river basin. Compare the Congo basin with the Zambesi basin.

7.—Continental Islands.

Madagascar.
Mauritius.

8.—Indentations and Projections.

Compare Southern Africa with the southern part of South America.

AUSTRALIA.

This continent, like Africa, is a plateau surrounded by mountains, with a short slope or slopes to the ocean.

1. Eastern slope.

Bound. Describe. How drained. Compare with Barbary slope; with Guiana slope; Appalachian slope.

2. Western slope.

Same questions as upon Eastern slope.

3. Northern slope.

4. Southern slope.

5. Great Basin or Plateau.

Compare with Sahara; with plateau of Southern Africa.

Comparison of Continents.

Compare North America with South America, Africa, Eurasia and Australia. Compare South America as above; Eurasia, Africa, Australia. Compare areas, lengths, breadths, coast lines. Ratio of length of coast line to area in each continent.

THE WORLD AS A WHOLE.

With the concepts of the continents already acquired, the student is now ready to form a concept of the world as a whole.

FIRST STEP.

1.—Relative Positions of the Continents on the Globe.

a Eastern and Western hemispheres.

b Northern and Southern hemispheres.

c Between what two lines of longitude is each continent situated?

d Between what lines of latitude?

e In what zones?

f Relative length and breadth of each continent.

g Compare areas of continents.

h Compare heights of continents. Greatest heights. Average heights.

SECOND STEP.

1.—Relation of Continents to Oceans.

To what oceans do the short slopes of the continents incline?

The long slopes?

Trace the short slopes of the Americas and Eurasia from Cape Horn to Spain.

Trace the long slope in the same way.

Show relation of continents to the North pole.

To the South pole.

2.—Distances Over the Oceans Between Continents.

a The shortest distances.

b The longest distances.

Over how many miles of water would one be obliged to go in order to travel from Cape Horn to Cape Finisterre? *

From Cape Horn to the Cape of Good Hope?

From Cape Horn to Melbourne in Australia?

Relation of Oceans to Drainage.

1. Slopes drained by the Pacific ocean.
2. Slopes drained by the Indian ocean.

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* Travel as far as possible on land.

3. Slopes drained by the Mediterranean sea.
4. Slopes drained by the Arctic ocean.
5. Enclosed basins.

THIRD STEP.

1.—Review of Structure of Continents.

Note.—If the concepts of continents have been clearly formed, the pupil can answer the following questions very easily:

Trace the continental axes of the Americas and Eurasia from Cape Horn to Spain.

Name the mountain ranges in order from Cape Horn to Spain over which the continental axes pass.

How many and what are the plains on the long slopes from Cape Horn to Spain?

Compare the areas of these plains. Which is the largest?

Name all the river basins in order that form the long slopes from Cape Horn to Spain.

Name the prominent river basins on the short slopes from Cape Horn to Spain.

Name the peninsulas, gulfs, bays and seas in order which indent the short slopes. The long slopes.

What two continents are the nearest alike in structure?

Between what two continents are the greatest differences in structure?

NOTE.—These questions should all be answered from the student's concept and not by means of memorized words.

2.—Islands.

a Relation of continental islands to the continents.

Compare Great Britain, the Japan islands, Madagascar, Java, Borneo, New Guinea, West Indies, Tasmania, New Zealand.

b Oceanic islands, Australasia, etc.

FOURTH STEP.

1.—General Distribution of Heat Over the Earth's Surface.

I.—By vertical and slanting rays, *i. e.*, rays at angles to vertical rays.

The general distribution of heat depends upon vertical and slanting (oblique) rays.

The greatest quantity of heat is distributed (1) by vertical rays; (2) a less quantity by rays at acute angles with verticality; (3) still less by rays at a medium angle; (4) the least by rays at the greatest angle.

1. Gives full tropical heat.
2. Sub-tropical heat.
3. Medium or temperate heat.
4. The least amount of heat, frigid zones.

The changes in distribution of heat from verticality to the greatest obliquity is exceedingly gradual, measured only by the very slightest change in the slant of rays. There are no abrupt changes caused by the rays themselves. Study.

a Causes of vertical and slanting rays. Why do slanting rays distribute less heat than vertical rays? Cover more space; pass through thicker masses of atmosphere.

b Orbit of the earth. What is it?

c Annual revolution of the earth around the sun. Perihelion, aphelion. The sun is nearer the earth in winter than it is in summer. Why is the North temperate zone cold in winter?

d Plane of the earth's orbit; what is it?

e Inclination of the earth's axis to the plane of its orbit.

f Distribution of heat by rotation of the earth. How much of the earth's surface does the sun shine upon at a time?

g Division of the earth's surface into zones or belts of heat.

PROBLEMS.

What are the causes of the division of the earth's surface into zones?

If the earth's axis were at right angles with plane of its orbit, how many and what would the zones be?

If the earth's axis were inclined forty-five degrees to the plane of its orbit, what would the result be? Would such an inclination of the earth's axis be more favorable to the distribution of heat?

What causes the arctic zones? The torrid zones? The temperate zones?

Bound the zones.

On what day does no ray from the sun touch the arctic zone? The antarctic zone?

How broad is the belt of vertical rays?

When does a vertical ray touch its northernmost limit? Southernmost limit?

How broad a space (east to west) do the slanting and vertical rays cover at any one time?

How long a distance (north to south) do the sun's rays cover at any one time?

How long a time is any given space on the earth's surface heated by rays at the same slant?

How many times in the year is the same space heated by rays at the same slant?

What causes the arctic and antarctic circles?

The tropic of Cancer? The tropic of Capricorn? The equator?

Give the distances in degrees and miles between arctic circle and the north pole. Arctic circle and tropic of Cancer. Tropic of Cancer and equator. Equator and tropic of Capricorn. Tropic of Cancer and tropic of Capricorn. Tropic of Capricorn and antarctic circle. When are the equinoxes? What causes the equinoxes? The solstices?

Describe the differences of heat in the different zones.

2.—Distribution of Heat by Elevations Above the Ocean Level.

Why does the heat grow less as we ascend to heights above the ocean level?

Note.—Study the barometer.

How can heights be measured by a barometer? Why does it take less heat to boil water on great heights, than on the plain below?

Is boiling water as hot upon a high mountain as it is upon lower levels?

What portions of the surfaces of continents are colder than the average temperature of the zones which contain them? In what zone can the temperature of every other zone be found? In what zone can the temperature of two zones be found? What would be the effect if the continents were 10,000 feet higher on an average?

3.—Distribution of Heat by Proximity to and Distance from the Ocean by Winds and Ocean Currents.

A careful study of ocean currents should here be made.

Trace the following ocean currents on the map and ascertain their causes:

Pacific Currents.

1. The great equatorial current.
2. South equatorial current.
3. North equatorial current.
4. Return current.
5. Polar currents.
6. Antarctic drift current.

Atlantic Currents.

1. Equatorial current.
2. Gulf stream.
3. Polar currents.

Currents of the Indian Ocean.

1. North equatorial current (effect of monsoons).
2. South equatorial currents.

NOTE.—This classification is taken from Guyot's Physical Geography.

Winds or Currents of Atmosphere.

1. Trade winds.
2. Anti-trade winds.
3. Calms of the equatorial zone.

4. The calm-belts of the north and south temperate zones.

5. Polar winds.

6. Land and sea breezes.

7. Monsoons.

8. Local winds, such as the sirocco, khamsin, harmattan, mistral, bora, purga and the northers.

This classification is taken substantially from Appleton's Physical Geography.

Questions Upon Winds and Ocean Currents.

What is the main cause of ocean currents?

What is the main cause of the trade and anti-trade winds?

What effect has the rotation of the earth upon ocean currents? Upon winds? Why? What effect have the winds upon ocean currents?

Do winds cause ocean currents?

Do ocean currents cause winds?

What obstacles change the direction of ocean currents? What effect do these obstacles have upon the direction of winds? Is the atmosphere stationary in calms? If heat expands air and forces it up, why does not the same air always descend when cooled? How can a current of cold air flow *under* (in an opposite direction) a current of warmer air?

NOTE.—Before the distribution of heat by winds and ocean currents can be understood, the effects of the retention and radiation of heat must be studied.

Which retains more heat, land or water? Why?

What kind of soil retains the most heat; gravel, sand, loam or clay? Why?

What is the law of retention and radiation?

Explain the causes of land and sea breezes, monsoons and other periodical winds.

How Winds and Ocean Currents Distribute Heat and Cold.

What is the general effect of winds upon temperature? When is the thermometer lowered by winds? When raised? Whence come the winds, generally, that raise the temperature? That lower it? Why? What effect have ocean currents upon the winds which pass over them? Compare the latitude of Labrador with that of Great Britain. Compare the temperature. Compare in the same manner Southern Greenland with Iceland; Labrador with British Columbia; New England with France; Alaska with Siberia.

Explain the causes of the differences in temperature.

Why is it colder in Prussia than it is in England?

NOTE.—Study carefully isothermal lines and explain the causes why places in the same latitude have different temperatures. See map of Isothermal Lines, p. 66, Appleton's Physical Geography.

Why are places near the ocean very cold or warm in winter? What places near the ocean are much warmer than other places in the same latitude?

Countries Protected from Cold Winds by Mountains.

1. Compare the temperature of Switzerland with that of Italy. What causes the difference?

2. Compare the temperature of India with that of the land immediately north of the Himalayas.

Distribution of Moisture.

In what part of the ocean is the greatest amount of water evaporated? Why? Where does the vapor go? What winds bring the most moisture to the continents? What winds bring the rain to North America? To South America? To Eurasia? To Africa? What parts of continents have the most rain? Why? What is the effect of highlands upon rainfall? What highlands intercept rain? Refer to map of "Rain Over the Globe," p. 86, Guyot's Physical Geography. What parts of continents are rainless? Why? Why is the desert of

Sahara rainless? Why is there little rain in the great central basin of North America? What parts of continents receive the greatest amount of rain? Why? Why do the Western Ghauts receive such an immense amount of rain? What other causes of condensation are there except the cold tops of mountains? What effect has the Arctic Current upon New England? What are periodical rains? Describe the tropical rains and their causes? What parts of continents are subject to periodical rains? What are the causes of the periodical rains of California? See questions, p. 96, Guyot's Physical Geography.

Distribution of Vegetation.

The distribution of vegetation depends upon:

1. Distribution of kinds of soil.

2. Distribution of heat.

3. Distribution of moisture.

4. Kinds of soil, from the coarsest gravel to the finest vegetable mold, depend entirely upon structure. Alluvial and vegetable soils are principally found at the lower edges of long slopes; *e. g.*, Mississippi valley, Ganges valley, Amazon valley, Yang-tse Kiang, and Hoang Ho valley. Poor soil, on the other hand, is generally found at the upper edges of long slopes. Some very rich soil can be accounted for by other forms of

structure than those which now exist; *e. g.*, Volga basin.

A general concept of structures will lead to a good general knowledge of the distribution of kinds of soil.

The distribution of heat depends upon:

1. Oblique and vertical rays of the sun.

2. Changes in obliquity or inclination of rays.

3. Height of land.

4. Heat brought by warm winds over warm ocean currents.

5. Proximity to and distance from the ocean.

6. Protection of surface against cold winds by mountain heights.

7. Openness of surface to cold winds, *i. e.*, prairies, steppes, pampas.

8. Differences in radiation from water and from different kinds of soil.

The distribution of moisture depends upon:

1. Warm winds coming over warm ocean currents.

2. Condensation of vapor in clouds by cold heights.

3. Condensation of vapor by cold winds from the North and from Arctic ocean currents.

4. Vegetation exercises a great influence upon the evaporation and condensation of moisture.

5. Periodical rains are caused by changes in heated areas, owing to changes of the earth's relative position as it moves around the sun in its orbit.

From a knowledge of soils, heat, and moisture, the sterility and relative arability of a continental surface may be determined.

General Distribution of Lands in Regard to Vegetable Life.

1. Barren or sterile lands.
2. Lands nearly barren.
3. Arable lands, *i. e.*, those which repay cultivation.
4. Fertile lands.
5. Very fertile lands.

Barren or sterile lands and lands nearly barren are caused:

1. By lack of heat. Lands bordering upon the Arctic ocean, *e. g.*, Tundra.
2. Upper parts of high mountains.
3. By lack of moisture—Sahara, desert of Gobi, Kalhari desert, central part of Australia.

Very fertile lands are caused:

1. By temperate heat, plenty of moisture and rich soil.
2. By tropical heat, plenty of moisture and rich soil.
3. By tropical heat, plenty of moisture and fair soil, *e. g.*, Brazil.

Divide up the surfaces of all the continents according to this classification of soils, and give reasons.

Distribution of Vegetable Life.

Distribution by zones:

1. Plants peculiar to tropics.
2. Plants peculiar to sub-tropics.
3. Plants peculiar to temperate zones.
4. Plants peculiar to frigid zones.

Distribution of Forests and Grassy Plains.

1. Regions of the pine.
2. Regions of the palm.
3. Prairies, steppes, llanos, pampas.
4. Great forest regions, *e. g.*, selvas.

Plant life peculiar to each continent, *e. g.*, Australia.

Distribution of Plants in Regard to Utility.

1. Food plants.
2. Shelter plants.
3. Clothing plants.
4. Medicinal plants.
5. Plants used for luxury.
6. Plants used for ornament.

On what lands is rice raised? Wheat? Rye? Corn? Potatoes? Sugar cane? Cotton? Flax? Caoutchouc? Forests for building? Tobacco? Coffee? Logwood? Grapes? Figs? Dates? Cinchona tree? Spices?

Bound and describe the largest wheat, rice, corn, and potato growing countries. Give reasons.

Where is the largest wheat country in the world? Rice? Corn? Forest? (See p. 94, Appleton's Physical Geography; p. 98, Guyot's Physical Geography.)

Distribution of Animal Life.

The distribution of animal life depends fundamentally upon the distribution of vegetable life, and as we have seen that vegetable life depends upon structure, heat, moisture and soil, so animal life is the direct product of all these causes.

Distribution of Animals in Zones.

1. Animals peculiar to the torrid zones.
2. Animals peculiar to the sub-tropics.
3. Animals peculiar to the temperate zones.
4. Animals peculiar to the frigid zones.

Other conditions:

1. Animals peculiar to forests or woody countries.
2. To open lands, *e. g.*, steppes, prairies.

3. To highlands and high mountains.
4. To lowlands.
5. To marshy lands.
6. To very dry lands.

Distribution in Regard to Use.

1. Animals used for food.
2. For clothing.
3. For shelter.
4. Beasts of burden and those used for transportation.
5. Scavengers.
6. Useless animals.*

What countries produce the most sheep? Cattle? Horses? Elephants? Camels? (See p. 104, Appleton's Physical Geography.)

Distribution of Races of Man.

The classification here used is taken from Appleton's Physical Geography.

1. THE BLACK TYPE:

a Negroes.	*e* Bushmen.
b Negritos.	*f* Australasians.
c Bantu.	*g* Tasmanians.
d Nama.	*h* Milanesians.

*Are there any useless animals?

2. The Yellow Type—Mongolian section:

I.—Mongol-Altai.
- *a* Turks.
- *b* Yakuts.
- *c* Tatars.
- *d* Kirghiz.
- *e* Mongols.
- *f* Ostiaks.
- *g* Samoyeds.

II.—Indo-Chinese.
- *a* Chinese.
- *b* Anamese.
- *c* Burmese.
- *d* Thibetans.
- *e* Tai.
- *f* Coreans.
- *g* Japanese.

III.—Hyperboreans.
- *a* Yukagirs.
- *b* Kariaks.
- *c* Kamtchatdales.

IV.—Esquimaux.
- *a* of Asia.
- *b* of America.
- *c* of Greenland.
- *d* Aleuts.

V.—European Section:
- *a* Magyars of Austria.
- *b* Hungary.

VI.—Maylayo-Polynesian section:
- *a* Pacific islands (Sandwich).
- *b* Maories of New Zealand.
- *c* Malays.

VII.—American Indian.

VIII.—Mound Builders.

IX.—Cliff Dwellers.

X.—Aztecs and Peruvians.

3. THE WHITE TYPE:

a Teutonic or Indo-Germanic.

b Caucasic.

c Afghan.

d Berber.

e Romanic.

f Semitic.

g Hamitic.

h Asiatic Aryans.

i Maiotzi.

j Ainos.

(See Ethnological Map, p. 113, Appleton's Physical Geography.)

Locate each type and each race under the type.

Describe the characteristics of each race; color, form, skull, height, features, intellectual and moral qualities.

What influence has the structure, climate and vegetation upon each race?

Describe food, clothing, shelter, occupations, religions and degrees of civilization of each race.

Distribution of Minerals and Metals.

Precious metals:

1. Gold.
2. Silver.

Metals used in manufactures:

1. Iron.
2. Platinum.
3. Mercury.
4. Copper.
5. Lead.
6. Tin.
7. Zinc.
8. Nickel.

Minerals used in building:

1.	Limestone.	3.	Sandstones.
2.	Granite.	4.	Clays and chalks.

Fuels:

1.	Coal.	3.	Peat.
2.	Petroleum.	4.	Natural Gas.

Other Minerals:

1.	Rock salt.	2.	Graphite.

(See map, p. 118, Appleton's Physical Geography.)

Political Divisions.

Having acquired a clear concept of the world, its structure, climate, vegetation, animal life, races of men, mineral products, the student is now ready to divide the continents into political divisions. Draw a map of each continent on the blackboard or upon a large sheet of paper. Separate the continents into political divisions by red chalk or red pencil.

Size of the political divisions of the largest areas may be made the basis of the first classification.

Largest Political Divisions.

	SQUARE MILES.
Russian Empire in Europe and Asia......	8,637,040
British Empire in Europe, Australia, Asia, Africa and North America............	8,178,215

Chinese Empire	4,553,102
United States	3,602,990
Brazil	3,219,000
Argentine Republic	1,094,968
Turkey in Europe and Asia	835,668
	30,120,983

Total surface of the continents, 52,524,775 square miles.

The territory occupied by seven nations is far more than one-half of the surface of all the continents.

This table may be continued in order of size.

Classification by Populations.

	INHABITANTS.
Chinese Empire	379,680,000
British Empire	299,308,293
Russian Empire	98,323,724
United States	50,442,066
German Empire	45,234,061
Austro-Hungary	37,869,954
France	37,058,485
Total population	947,916,583

Population of all the continents, 1,433,888,111.

The population of five empires and two republics

is more than two-thirds of the population of all the continents.

Classification of Political Divisions According to Forms of Government.

1. Tribal form.
2. Absolute monarchies.
3. Limited monarchies.
4. Republics.

As a political division is suggested under the different classifications, *draw it;* then if the student's concepts of the continents are clear, he can easily describe the structure (highlands, lowlands, plains), the drainage (rivers and river basins), the climate, soil, vegetable products, minerals, metals, animal life, and races of men of each political division as he draws it. More than this, he can understand the relation of each particular division to the continent, to the oceans, and to the world. This process follows the pedagogical law of going from the *whole* to the *part.*

Commerce and Manufactures.

From the basis already acquired the commerce and manufactures of the whole world may be very easily studied.

1. Great ocean routes and the ports connecting them.

2. Great river routes.

3. Great railroads of the world.

4. Great commercial cities; their exports and imports.

5. Great manufacturing cities; articles manufactured in them. (See commercial map, Barnes' Complete Geography, p. 133.)

These questions should be asked of each country:

What are the principal articles it furnishes other countries, *i. e.*, vegetable and mineral products and manufactured articles?

What articles does it receive from other countries?

Select twenty of the ports (commercial cities) of the world and ascertain the principal exports and imports of each city.

What relation do the structure, climate, soil and minerals have to do with the wealth of each city?

What great cities owe their wealth to neither commerce nor manufactures?

Special Studies of Countries of Great Historical Importance.

1. Palestine.
2. Basin of Tigris and Euphrates.
3. Egypt.

4. Greece.
5. Italy.
6. Germany.
7. Spain.
8. Holland.
9. Great Britain.
10. United States.
11. India.
12. China.

In order to understand and fix in the mind the great events of history these countries should be thoroughly studied in this order.

1. Relations to continent.
2. Structure.
3. Drainage.
4. Soil.
5. Climate.
6. Vegetable products.
7. Mineral.
8. Races of men.

9. Advantages in structure for defense against enemies.

10. Commercial situation.

11. Advantages for manufactures.

12. Influences of the above upon the character of the inhabitants.

OUTLINE OF A COURSE OF STUDY.

ELEMENTARY GEOGRAPHY.

FIRST GRADE.

First Term—

a Color.

b Form.

c Number.

d Distance.

e Direction.

f Location of everything in stories told or read.

g Observations of changes in seasons, rain, snow, clouds, ice, frost, effects of moisture upon plant life.

h Plants, seeds sown in room, in garden; trees.

i Animals; what they eat; kinds of; uses; domestic animals; wild animals.

j Fairy tales illustrated by pictures.

SECOND TERM—

Continue first term work.

a Observations of boiling water.

b Steam, vapor.

c Forms of water.

THIRD TERM—

Continue previous work.

a Sunlight, changes in room.

b Rising and setting of sun.

c Moon and stars.

d Effects of heat and cold.

e Movements of air; winds.

SECOND GRADE.

Continue all previous observations throughout the year.

FIRST TERM–

a Areas.

b Location of rooms in school-house.

c Location of school-house, location of yard, of streets and houses in the vicinity.

SECOND TERM—

a Horizon, sky, zenith; vertical and horizontal lines.

b Observation of natural features of land; hills, valleys, rivers, ponds, etc.

c How plants grow.

THIRD TERM—

a Illustrate stories read or told, by pictures and maps drawn upon the blackboard.

b Migration of birds.

THIRD GRADE.

Continue all work indicated in first and second grades throughout the year.

FIRST TERM—

a Locate all places mentioned in history of the Eskimos.

b Observation of soils; gravel, sand, loam, rocks.

c Observation of common minerals and metals.

d Consider effects of heat, cold, air, water, soil and plant life upon each other.

e Study features of surface structure in relation to heat, cold, moisture, air, etc.

SECOND TERM—

a Relation of clouds, vapor, light and heat, to rain, and rain to plant life.

b Locate places in history.

THIRD TERM—

Review all previous work.

FOURTH GRADE.

FIRST TERM—

a Collect carefully the results of all previous observations and study. Lead pupils to see the relations of the facts they have acquired.

b Systematic study of all forms of land and water.

c Hills.

d Ridges, chains of hills.

e Stories of mountains and mountain systems.

f Valleys, plains, lowlands.

g Stories of prairies, steppes, selvas, llanos, etc.

SECOND TERM—

a Drainage.

b Percolation of water through the soil.

c Use of the water in the soil; vegetation.

d Springs, brooks, rivers.

e Ponds, lakes, swamps.

f Stories of snow on mountains, glaciers, icebergs.

g Wells, artesian wells, canals and ditches.

THIRD TERM—

a River basin; bring all the results of observation to bear upon this unit of drainage.

b Coast lines.

c Promontories.

d Capes.

e Peninsulas.

f Islands.

g Gulfs, bays, seas.

h Wearing coasts, building coasts, tides of the ocean.

i Stories, descriptions and illustrations of these forms which lie outside of the pupil's observation.

FIFTH GRADE.

SCIENTIFIC GEOGRAPHY.

Bring together in the pupil's mind the results of all previous observations and studies.

Use these results or this acquired power at every step of the building or the imaging of the

continents. If the proper preparation for scientific geography has not been made, *make it*.

FIRST TERM—

a Review all previous work and strengthen all the weak places.

b Structure of North America. Concentrate all work upon structure.

c Drainage.
d River basins.
e Soil.
f Climate.
g Vegetation.
h Animals.
i Races of men.

j A general view of political divisions.

k Comparison of slope with slope, basin with basin.

SECOND TERM—

Same as first term.

THIRD TERM—

a Structure of South America.
b Drainage.
c River basins.
d Soil.
e Climate.
f Vegetation.
g Races of men.
h Animals.
i General view of political divisions.
j Comparison with North America.

SIXTH GRADE.

FIRST TERM—

a Structure of Eurasia. Follow the same course as in North America and South America.

b Structure of Europe.

c Structure of Asia.

d Compare Europe with Asia.

e Compare Eurasia with North America.

f Compare Eurasia with South America.

g Compare with North and South America taken together.

SECOND TERM—

a Structure of Africa. Follow the same course as in North America and South America.

b Compare with each of the continents already taught.

c Australasia, structure of.

d Australia, structure of.

e Compare Australia with the structure of each of the continents.

THIRD TERM—

a The earth as a sphere.

b Locate all the continents upon the globe.

c Locate the islands, oceanic and continental.

d The oceans.

e Relations of oceans to continents.

f Ocean currents.

SEVENTH GRADE.

FIRST TERM—

a Distribution of heat.

b Motions of the earth.

c Distribution of heat by zones; elevations; winds and ocean currents.

d Distribution of moisture.

e Winds.

SECOND TERM—

a Distribution of soils.

b Distribution of vegetation and vegetable products.

c Distribution of animals.

THIRD TERM—

a Distribution of men.

b Races of men.

c Distribution of minerals and metals.

EIGHTH GRADE.

FIRST TERM—

a Governments.

b Conditions of governments.

c Forms of governments.

d Tribal forms.

e Absolute monarchies.

f Limited monarchies.

g Republics.

h Distribution of political divisions over the earth.

i Capitals and principal cities.

SECOND TERM—

a Structure, soil, climate, vegetable products, manufacturing and commercial advantages of each political division.

b Manufactures of the world.

c Commerce of the world.

d Great cities of the world.

What made them great?

THIRD TERM—

a Special structures of very important political divisions (important in the history of the past and present).

b Persia and Syria.

c Palestine.

d Egypt.

e Greece.

f Italy.

g Spain.

h France.

i Great Britain.

j Germany.

k Holland.

l United States.

NOTE.—Political geography is historical geography, and is taught in connection with history; (see Course in History, to be prepared for the Cook County Normal School).

SUGGESTIONS AND DIRECTIONS.

1. This outline of a course of study is an attempt to adapt the subjects, by grades and terms, to the different stages of development or power to grasp and comprehend thought. If, however, in any grade or term the work up to the time has not been done—if pupils have not the power to go on—then the *previous work must be done.* The rule is *begin where you find the pupil.*

2. **One direction** stands above all others in importance; it is the formation of the habit, on the part of the pupils, of *locating every place, natural feature, and country, mentioned in reading and study.* This habit should be *sedulously cultivated from the beginning to the end.* In the fairy and other stories of the lower grades, illustrate by pictures drawn upon the blackboard; make little sketch maps of the places. Follow in a little map the travels of "Red Riding Hood," of "Silverhair" and "The Three Bears." Draw maps, and have pupils do the same, of any place or country described in reading. Not only draw the maps, but try

to lead pupils to imagine the surrounding features. In class reading and study have a map upon the board or draw one, and locate each place. When studying at their desks pupils may locate by using maps in the text book.

3. **In teaching history,** geography should be used at every step. Before a single fact is taught, the structural geography of the country whose history is to be learned should be thoroughly comprehended. The drainage, climate, vegetation, animal life, races of men and all other influences that bear upon civilization should be related to the structure in one great, distinct picture, so that the social, religious and political acts of men shall pass under the eyes of the pupils upon a real stage, a stage made up of hills, mountains, plains, coasts, rivers and valleys, upon which the characters of history "live and move and have their being." Events are thus permanently fixed in the philosophical memory with the particular stage upon which they were enacted. In addition to this indispensable means of cultivating the philosophical memory, the association of events with structure, climate, etc., leads directly to the investigation of causes, the essential basis of the philosophy of history.

Have the molding board always ready to make vivid the places and their environment. Keep a large outline map upon the board upon which to mark the

places, draw new political boundaries, or to change old boundaries. How does this place or country look? What are its relations to the whole continent? should be continual questions. For instance, in teaching the history of the United States, review first the continent of North America; lead pupils to see how it looked before its discovery. Then as the discoveries are made, follow the footsteps of the discoverers; as the settlers arrive and colonize the country, mark off boundaries until the thirteen colonies with all the land which belonged to them are outlined; indicate the foundation of each new city. Then follow closely, in geography, the evolution of the states. *In ancient history*, the same thorough work should be done; Mesopotamia, Palestine, Egypt, Greece, Italy should have clear, corresponding pictures in the minds of pupils. Nothing should be left in the air; Athens, Sparta, Rome, in their essential features, can be as familiar to the pupils as the streets of their native town.

The structure, climate and vegetation have very much to do with the civilization and progress of a people. *Keep these facts in mind.* Keep constantly before you that the memory of events must have its philosophic basis founded upon a clear concept of the territory upon which the events occurred.

4. **Curiosity** is the strongest intellectual tendency; keeping it fully alive in the right directions, means intel-

lectual growth. The child is very curious in regard to *the beyond*. If his mind is in a normal condition he is always interrogating nature. This important fact the teacher should always keep in mind and use for the benefit of her pupils. The little one, out of a meager stock of ideas, creates a world for itself. Myths and fairy tales are the child's true mental pabulum, as they were of the childhood of the world; they burst the bonds of a limited reality and give children the first elements of faith, *of spiritual life*.

Keep this sacred fire of curiosity alive in the child's soul; myth and fairy tale are the nebulæ of reality. Tell a little child that the earth is "round, and like a ball seems swinging in the air." It is nothing to him except a thing of wonder; long years of study must elapse before the world becomes really round to him; but the story, more a myth than "Jack and the Bean Stalk," arouses curiosity; it is a spark that may kindle into a flame, if the teacher has the good sense to do nothing more than *tell* the wonderful story. Tell the child of the great world beyond; of mountains with snowy heights; of valleys, rivers, and oceans; the vague ideas aroused will excite a burning curiosity which furnishes the stimulus under proper direction for careful and thorough investigation and research. The fruitless attempt to teach any generalization before the facts, out of which the generalization is in-

duced, are in the mind, has for its product a lasting disgust for the subject taught.

All through the course, that which is to be made real to pupils, should have forerunners in stories and travels. Miss Jane Andrew's wonderful books should be read by children in the third and fourth grades—"Seven Little Sisters," "Each and All;" and in the seventh grade—"Ten Boys of Long Ago." "Aunt Martha's Corner Cupboard," is an excellent book of the same kind.

It should be remembered, however, that although this kind of reading arouses curiosity and stimulates to study, it cannot be called, strictly speaking, scientific study. Stories and travels are not in themselves elements in scientific geography, but simply incidents which serve to spur the mind on to search for the truths which they shadow forth.

Curiosity, like all fundamental, innate tendencies, must be led by the most careful teaching. A precept, to the child may be a falsehood, while a beautiful fairy tale may contain a rich kernel of truth. But unless the truth imbedded in myth or fairy tale be developed into reality, it may lead to unreasoning belief or the wildest fanaticism. In mental evolution there comes a time when the child will merge this love for myth into a broader love for reality; the old will blend with the new; and it is of the utmost importance that the teacher

watch carefully this gradual change and apply the new conditions at every stage of the new growth.

Undirected curiosity, unrestrained love for fairy tales, myths, and travels, will develop little of worth. The teacher with a mind full of the great ideal, the mental in-building of a concept of this great earth, must by careful teaching change this vagueness, this mental nebulæ, into the grand reality. The fairy tale is truth to the child, the real, round world should be truth to the man.

5. **The power to understand a map correctly** is of indispensable importance in the study of geography. It may be truthfully said that the main end and aim of teaching geography is the power to interpret maps. A map is a picture and something less than a picture; it is much more than a symbol or a set of symbols. Its primary use is to build in the mind an individual concept corresponding to the structure (relief) of a country; its secondary use is to fill into this individual concept the subordinate (and associated) concepts of drainage, soil, climate, vegetation, animals, races of men, places, political boundaries, in fact all the essential facts pertaining to the country. The end to be attained is that the map shall recall a great vivid picture or assemblage of blended concepts. A map should live and glow with life and movement.

Like words and pictures, a map is an external

means of recalling an appropriate concept, a concept that corresponds (approximately) to a real country, a real continent, a real world. The true psychological effect of a map is: 1st, the external object (the map); 2nd, a concept (aroused by the map) and corresponding to the map; 3rd, the corresponding concept recalling the appropriate concept, the concept corresponding to the country. Now the very common effect—an effect almost universal—is that the map recalls nothing but its corresponding concept (the map itself); it awakens in consciousness nothing beyond itself, no gleam of light, color, or shade, beyond the mere correspondence to itself. The pupil thinks *of* the map, *in* the map, and is limited in thought entirely to its narrow boundaries, its patches of colored paper. This constrains and confines mental action and induces a *habit* that long, earnest mental struggles may, and, alas, may not break up. Test yourself. Do you see the map alone, or the country represented by the map? This terrible habit—terrible in its results upon human intelligence—is early formed by presenting incomprehensible maps to children and forcing them to commit to memory the black lines of river and coast, the little dots for places, and the colored lines of political boundaries; under such teaching this habit is inevitable, and a map instead of performing its proper function in recollection, instead of calling into consciousness a beautiful picture

glowing with variegated life in a unit of form; instead, in a word, of enlarging the mind's scope and quickening the power of imagination, restrains and confines the thought to a meaningless muddle of color and form.

The faults of map-teaching are identical with the faults of word-teaching. Teaching words before ideas has the same effect as teaching a map without associating it with that which it represents. The problem of how to lead children to use maps properly, that is, to make a map a means of developing thought power, is an exceedingly serious and important one, in fact it may be called the end and aim of teaching geography; therefore, all directions and suggestions should tend toward this one purpose. Some general rules may be here given:

I. Begin with careful observation of the land around the school-house; hills, valleys, etc. Have pupils mold and draw maps of the natural features that they observe.

II. Use simple maps, embracing very few features. A map for teaching is entirely different from a map for reference.

III. Train pupils into the habit of picturing the country the map represents. Ask questions that will lead them to imagine the natural features, and never use a map so complete that it will prevent their making mentally vivid the reality.

IV. For primary teaching (in third, fourth and fifth grades) never use anything but structural maps.

V. *Above all, have the structure distinctly in your own mind* before you attempt to teach it. Vagueness on the part of the teacher is generally the main fault in teaching.

VI. *A map recalls the reality* because it has some attributes which correspond in themselves and in their arrangement to the attributes and arrangement of attributes in the country the map represents. The closer the correspondence of the map is to reality the more influence it has in recalling the reality. A map (like the maps commonly used) which contains no mark or sign of elevation, teaches horizontal outlines and nothing more. A physical or structural map recalls elevations and other surface features.

Teaching the surface of a country is impossible without the means of indicating the natural features of that country. You teach flat maps and call it geography, but it is simply a surface of colored paper and nothing more. "*Geography is a description of the surface of the earth.*" How can the surface be *described* without first mentally picturing the surface, and how can one conceive in the slightest degree, the natural surface features without the means of such mental action; and what means can be used other than pictures, models and descriptions of vertical sections? Words fail without

adequate illustration. The pedagogical demand in method, since the time of Humboldt and Ritter, for teachers of geography, has been how to teach the upraised land masses.

6. **Relief Maps.** One device has been used for a long time by many teachers, and that is the illustration of elevations by models or reliefs. Many teachers, however, argue against the use of relief, claiming that altitudes, in comparison with horizontal distances, are very much exaggerated; that heights are out of proportion with lengths, lateral and transverse. This statement is true, and it is also true that maps with relatively exact proportions cannot be made for school-room use, and if they could they would be of little or no use in teaching geography, as the highest elevation would nearly coincide with the plane of the ocean level. The questions to be decided are; can relief maps be used so as to give pupils the *general* truths of the continental organism? Is the necessary exaggeration above mentioned an insuperable objection?

Like all other pedagogical questions, this question must be discussed and decided upon purely psychological grounds. If with the known defects, relief maps aid the mind in the formation of relatively true concepts, then they should be used; if not, they should be discarded.

The use of relief maps, and of molding maps in

sand, clay and putty involves other devices for teaching elevations; for instance, *profiles* of vertical sections have been used ever since any attempt to teach scientific geography has been made. Guyot used them extensively, and all physical geographies illustrate elevations and slopes by them; in topographical surveys the same illustrations are used. Profiles are exaggerations of heights in relation to horizontal distances in precisely the same way that relief maps are exaggerations. Photographs or pictures of relief maps (now used extensively in common school geographies) and bird's eye views are also untrue in the relations of heights to breadths and lengths. So that profiles and pictures of reliefs, in fact, all graphic representations of elevations or vertical sections, being open to the same objections as relief maps, must be given up in teaching, if sound reasoning sustains the objection in regard to exaggerated heights.

I. Structural geography, or geography *per se*, is the in-formation (mental in-building) of concepts corresponding to the structure of continents. Without the concept of structure, elevations, slopes, and their relations, true geography is a perfect impossibility, for geography minus structure is a plane or flat surface—an unmixed untruth.

II. The process of this in-formation or in-building of concepts corresponding to continental structures is by

apperception. Apperception is the strengthening, blending, commingling, and combining of elementary ideas and concepts which have been formed in the mind by actual observation or direct sense-contact. External objects—hills, valleys, etc., cause mental pictures, which by apperception are reformed in wholes (concepts) of objects which lie entirely beyond the sense-grasp. All mental creatures of fancy or reality are thus *in*-formed. The main purpose in teaching scientific geography is so to blend, commingle, strengthen, and combine the products of the senses that the objective product will be a concept which corresponds, in *general elements, to the general* features of the continent. The problem of sense-contact or actual observation is (in theory) easily solved, but the means to be used in building the concepts, whose corresponding objects are entirely beyond sense-grasp, is far more difficult.

III. It is evident that graphic and symbolic devices must be used to create the much-to-be-desired concept. As actual correspondence in form and structure is out of the question, the most essential external means is that graphic device which has in itself the most attributes and relation of attributes that correspond to the actual but unseen form. *A flat political map* has the fewest possible corresponding attributes; its correspondence consists entirely of indications of horizontal forms; it contains absolutely no correspondence in elevation.

Lines indicating coast lines and rivers make up the entire correspondence in structure. Mountains which are the summits of slopes, it is true, are indicated, but by marks which have little or no correspondence with the actual elevations or forms of elevations.

Physical or structural maps are filled with graphic illustrations of upraised structure, but the mental power to interpret the signs in physical maps is the end of geographical teaching, and is far removed from the initial steps. The multifarious symbols that make up a physical map are to the beginner in a grammar grade a confused mass of unmeaning hieroglyphics, and to present such a map to a grammar pupil is to begin with a full and rounded generalization, a direct violation of the principles of induction.

IV. *Oral and printed descriptions* of surface are indispensable in the formation of clear concepts, but are they an adequate means in the full building of the proper concepts?

Vivid and accurate descriptions are much more effective than either flat political or physical maps, but it is evident there must be some graphic illustration. There is no doubt but that simple structural maps may be used with great effect; yet when an illustration of a slope like that stretching westward from the Mississippi to the Rocky Mountains, and also an illustration to show the relation of that slope to the mountains which

crown it, nothing is more natural for a teacher than to step to a blackboard and draw an inclined line indicative of the slope. This line is untrue, say the objectors, because it fails to show relative height. *How, then, can it be shown?*

V. The flat copy political map contains very little truth and that is confined entirely to horizontal form.

Physical maps cannot be understood until they are associated with the reality. Descriptions fail to create the proper concepts.

Relief maps, profiles and pictures of relief maps contain a great deal more truth to the young learner than all other means combined. The slopes, mountain systems, hills, valleys, river basins, in fact the general organism is the truth from which the life, the drainage, facts of climate, soil, production and history may be educed and understood. The choice then seems to lie between little or no truth, and very much truth with an element of error. It is a question of geography or little or no geography.

VI. *Judgment* is the modifying interpreting faculty of the mind. Through this power acting upon sense products the correspondence between the internal and

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NOTE.—The representations of outlines or coast lines contain very much that is decidedly untrue; for instance, the entire coast line of the Arctic ocean has never been topographically surveyed, and its representation in maps is mere guess work from casual observations. The same can be said of many rivers, lakes and mountains.

external is made true. The moon (in unformed judgment) touches the eyes of the little child; judgment acting on facts of experience removes it farther and farther away. A house a short distance away is to the senses one inch high, to the judgment (acquired perception) it may be fifty feet high. By precisely the same mental power the inequalities of heights and horizontal distances by a strictly natural process will be changed to the reality.

Relief maps have been in use for a long time; they are recommended by many eminent teachers of geography. Geike, who is a great authority in the English speaking world, strongly recommends the molding of relief maps in teaching primary geography. It may be safely questioned whether classes which do not use this seemingly indispensable means really learn structural geography. This suspicion is enhanced by the results of the examination of many graduates of high schools, who do not seem to have learned anything beyond the mere picture of a map.

7. **Drawing,** next to molding, is the most efficient means of studying geography. It goes, however, without saying, that both molding and drawing may be continually used, and used with the highest degree of technical skill, and still no essential geography be learned. That molding or drawing which simply reproduces the form of a map without enhancing the con-

cepts of surface structure is of no use whatever; it is worse than useless, for it blinds the pupil, and hinders him from a knowledge of the reality. *The only use of molding and drawing is to build in the mind a picture or concept of a country or continent.* At all times in drawing and molding, pupils should be led to think or to picture the country. While a coast line is being drawn, the kind of coast should be mentally seen; whether it is a wearing or a building coast; why the coast has this or that form; the mountains, hills, cliffs or plains that form the coast; the kind of harbors; the uses of the bays and other indentations; why such and such a peninsula, cape or promontory is where it is; in fact the coast should be full of reality, the pictures should be clear and even vivid. The same can be said of all drawing and molding; rivers should be followed in their courses, the causes of the river, its slopes, basin, channel, bendings, rapidity of flow, depth, effects of erosion, uses in manufactures, navigation and irrigation; mountains with their snowy heights, glaciers, passes, ravines, plateaus should spring from the moving crayon or pencil. Question should follow question; questions which interfere with accuracy even can be made to materially aid in forming distinct pictures.

The question whether construction lines should be used in drawing is a serious one. Certainly a better map may be drawn with construction lines; but, does the pupil gain as much from the drawing of a map on

such lines as he would if obliged to trust his mental picture alone and to represent that? The map itself will generally be more imperfect without construction lines, but the mental result will be far better, and the mental is the *one* purpose of the work.

In the end it may also be safely said that the skill in drawing will be much greater because of the constant reliance upon mental pictures unhindered by the use of construction crutches. *The only safe rule to follow, always and always, is to consider the mental power as the one thing to be gained and to bend every means stoutly and persistently toward this end.* The teacher's fear of crudeness and marked imperfections in expression, on the part of the child, very often robs him (the child) of much true development. Pupils should draw a great deal; the direction "draw that" should be given at every step. *Great skill in drawing* on the part of the teacher, exercises an immense influence for good over the advancement and mental growth of pupils. No one who has had the good fortune to see Agassiz and Morse teach can ever forget the power that they exercised by their marvelous skill in delineating and illustrating their lessons. Drawing is a *second right arm* and every teacher is morally bound to acquire skill in the art. *Draw,* however, no matter how poorly you may do it—*draw, and keep on drawing.*

8. **In the art of questioning** is concentrated the art of teaching. The art of teaching has just one mo-

tive,—the arousing and exciting of those conscious activities which, in all steps and stages of mental action, conform to all-sided growth. A pedagogical question brings about a certain definite conscious activity, an activity directly needed for the development of mental power. It stimulates and intensifies thought by recalling and concentrating concepts, judgments and trains of reasoning. It leads to the discovery and evolution of new judgments or inferences out of the thought already in the mind of the pupil. In synthetizing, analyzing, comparing and judging, mental power is more economically exercised by questioning than it is by any other means. A true question leads and stimulates a *search for truth*. No matter how great the difficulty, if the truth is within the possible grasp of the pupil, the search and the finding will always bring to the pupil the keenest emotions of pleasure. A question, according to Jacotot, "starts a quarry for the class to hunt down." Each question should arouse the thought power, not of one, nor a few, but of the *whole* class. It should demand, in the highest normal degree, the exercise of that mental activity which we denominate attention or concentration. An answer should be a powerful lens, through which the teacher closely watches every movement of consciousness, so that he can detect the least failure and encourage the slightest success. A succession of proper questions is an exam-

ination of the highest order. The real test of power is found in not merely recalling what a pupil has thought, but in using the old to discover the new.

The kind and intensity of the conscious activities (thinking) on the part of the pupils should always govern the questions; that is, the order of questioning should be the order of the evolution of thought. The teacher, ever on the alert, and watching the mental acts of his pupils, should so shape his questions as to use the mental properties and powers of his pupils in the best possible way. *Pupils generally possess a great many isolated facts which may be brought together and related by judicious questioning.* Never force an answer, but be sure your question arouses some definite, conscious activity, then give pupils time to think.

The great art of questioning may be entirely misdirected, like all other good things in teaching, by using it as a means of verbally memorizing words. A question, too often, demands an *answer*, not a thought; the pupil is aroused to mental action in *recalling words and sentences already learned*, or in framing a new sentence which he suspects is required. This terrible fault lies wholly in the teaching and not in the pupils, for they dearly love to think *when they have a chance;* but alas! the habit of recalling words induced and fostered by injudicious teaching takes strong hold upon them and *keeps them from thinking in school*, at least. The one

serious inquiry teachers should make at each step of a recitation is: Do I ask this question for the *thought* or for the *answer?* The difference between the two purposes is world-wide. One presents the artist teacher dealing with the best interests of the child; the other an artisan teacher having in mind the personal interests of a high per cent upon a verbal memory examination.

Questioning in structural geography is the simplest, easiest and most delightful of all questioning, because proper questions bring into the pupil's mental vision clear and pleasant pictures of varying and variegated surfaces. Each picture, beautiful in itself, contains some problem of cause and effect, or both, to be solved by investigation. Where does the rain go when it falls upon the ground? How far into the ground does it go? Where does it stop? Where does it come out of the ground? What good does it do in the ground? How much land does a river drain? are questions that require the presence in consciousness of clear pictures, by means of which the pupils form judgments and draw inferences. The thought-arousing teacher closely watches the mental activities of his pupils; he instantly grasps a difficulty, and, if necessary, asks another question to help overcome it; he looks upon that aid which lessens mental activity in the right direction as a pedagogical crime; he gives credit for every honest *attempt* to think; he never demands any set form in an answer;

he delights to find that he has led pupils to discover truths that he never had himself. To a teacher who is master of his subject, any feature of land or water fairly bristles with questions. A continent is a precious mine of problems, comparisons, resemblances, differences, causes, effects, which follow each other in his full mind in rapid succession. This oneness of motive—to develop power—and this plenitude of the subject taught begets an enthusiasm in teaching unequaled by that of any other art.

It cannot be urged, here and elsewhere, too strongly and too persistently that the teacher should *master his subject.* Perfunctory questioning from a text-book means nothing more nor less than ignorance of the subject. Think of a teacher standing before a beautiful landscape asking questions about that landscape from a text-book!

The study of geography presents countless opportunities for the cultivation of language, both oral and written. The prime function of all modes of expression in mind development is to relate and intensify thought under the direct influence of the will. Each mode of expression (language, drawing, making, etc.) has its special and particular office, an office for which no other mode can be made a substitute. Language is especially adapted to the formation of judgment and the cultivation of the reasoning powers. Judgment is

cultivated, it is true, by all modes of expression; but the direct expression of judgment is confined to language. Oral language demands quick, intense power; written language slower and more deliberate mental action. Both oral and written language demand the same *kind* of conscious activity, the difference is only in degree of intensity. Under the more deliberate action required by written language, more facts are generally related, and the generalizations springing from them have a tendency to come nearer to the truth. Perhaps the most important of all pedagogical questions is this one:

Can language both oral and written be molded, shaped and sufficiently developed in all its details of idioms, pronunciation, enunciation, articulation, penmanship, spelling, punctuation, use of capitals, accent, harmony, melody, etymology, syntax and all the accidents of grammatical construction, by using it as an *immediate* means of thought development?

In other words, can language be adequately developed under the white heat of thought? Is there any real necessity for the using a sentence either oral or written which does not directly aid in developing higher power than the power to mechanically use the accurate forms of language itself? The highest and only functions of language are those of an economic means of thinking and of recalling thought. Can these functions be constantly used at every step and stage of development, or must

there be a preparation for their use by the study of language, *per se*, as an isolated and detached subject?

If, by using language, under scientific teaching, both oral and written, in its proper and only functions of thought development, the language itself can be sufficiently developed in beauty and power, then all cultivation of language in form and accuracy may best be done precisely as it is done, and has been done throughout the ages in the learning of the oral language by children before they enter school. First, the correct model or pattern for imitation; second, the thought and a desire to utter it; third, the correction of mistakes by the parent or teacher in the utterance. *The development of the language depends entirely upon the development of the thought.* Making the language (oral and written) adequate to the clear, concise and complete expression of thought must be a product of the greatest skill and care on the part of the teacher. If, then, these modes of expression can be made an essential and immediate means of arousing and stimulating those conscious activities directly conducive to growth, and at the same time and through their influences language may be adequately developed, it is plain that a very large amount of school work may be dropped, or better, may assume a far better place in the economy of symmetrical development.

Instead of teaching spelling, penmanship, lan-

guage lessons and grammar as isolated subjects, taking so much time and toil, they would become essential accidents, indispensable and economical means in the direct development of thought power.

It is claimed that the teaching of words and the formal arrangement of sentences cultivates thought power and is, in fact, a great mental discipline. For want of better subjects of discipline this claim might be allowed, but no good reasons can be given for placing the mental power acquired in mastering geography, history, the natural sciences and mathematics below, or even *with* that of the most prolonged study of the forms of thought expression. It will be granted that all the forms of language (with the exception of unphonetic spelling) are essential factors in the evolution of thought. If, then, all the forms and details of language may be the *direct* and *immediate* means of intensifying and compacting conscious activities, and by using them as direct means the language in itself, in all its forms and details, may thus be best acquired, why take the time from the main subjects to exercise pupils in the forms of thought without the essential thinking itself? Does not the use of language, as an immediate demand for and constant stimulus to thought, raise the dignity, influence and importance of language itself to a far higher place than the formal study of words and sentences?

It will be granted, too, that language should always be genuine and sincere; it, in other words, should conform to the thought; it should spring spontaneously from the conscious activities; it should be an immediate necessity for thought expression. And when it thus springs from the mind in full action, from the white heat of thought, it seems that it can be best corrected, molded and enhanced by new details and modifications which at the same time mold, modify and enhance the thought itself.

Several very practical questions must be answered in support of this theory:

1. Will there be words enough used in pronunciation, spelling and penmanship for practical use, and will there be sentences enough used for training in punctuation and the use of capitals?

2. Will there be sufficient *repetitions* of these forms to fix them in the mind ready at any time for automatic use?

3. Will the legibility and ease of penmanship be as good as they are when penmanship is taught as an art by itself?

4. Will the pupils have the same command of idioms, of compound and complex sentences and all the modifications that make up the grammatical analysis under this method?

These questions can, at least, be partially answered by a comprehensive glance at the work to be done or

the thought to be evolved in teaching the great science of geography.

Teaching geography as it should be taught brings about the mental evolution of a great logical whole of truth. Each fact, detail and particular becomes an organic element in the organic whole. Products of observation form the essential basis of the upbuilding. The order of growth is from simple observed facts to simple generalizations; from simple generalizations to analysis; from grouped and related generalizations to higher generalizations; from effects to causes; from causes to effects. The *whole* contains in logical and related order each fact and generalization; the last generalization is the relation and outgrowth of all preceding generalizations.

Oral and written language is the principal external means of this development. The evolution of the thought demands the evolution of that language which conforms to the thought, and is adequate to its expression. Simple facts require simple sentences; generalizations, compound and complex sentences; in fact there is no modification to be found in the closest and most minute grammatical or logical analysis in which pupils would not be fully exercised both in writing and speaking if the teaching is scientific, or in other words, properly and fully adapted to growth. Every form, detail, accident could be used when needed by the thought,

and sufficiently exercised or repeated until it becomes a product of automatic action. Under this presentation the questions above given can receive affirmative answers.

1. There is no spelling book extant which contains the number of words that should be used in teaching geography. By the writing actually necessary to the proper development of the subject, spelling, punctuation, use of capitals and penmanship can be exercised up to the stage of complete skill, *if pupils are made to do their best every time they write.*

2. Fixing and relating the thought demand the necessary repetitions.

3. There is no reason why the acquisition of skill in penmanship should not follow the same laws of exercise and repetition as the acquisition of skill in pronunciation, enunciation and articulation; that is, it should be acquired under the direct influence and necessities of thought. Penmanship is much less complex than spelling, and the physical effort (if the shortest line of resistance be used) is consequently much less.

4. The fourth question has already been answered, but this proviso must be added, and strongly urged: If *forms* of thought expression are made the *end and aim* of teaching; if teaching demands expression rather than thought; if pupils memorize text; if the examinations put a premium on the sentences pupils can

write or otherwise repeat, then any attempt to teach forms wholly in connection with thought will be fruitless. With *form as the end,* spelling, penmanship, grammar. *must be taught* as isolated subjects, as they present in method the matter and means determined by the one motive of making language the end and aim of teaching. The theory presented in these pages is founded upon the motive of harmonious and symmetrical development.*

A few suggestions in regard to the teaching may be repeated here:

I. Oral and written language should be continually used in every step of the teaching.

II. The language used by pupils should be *their own;* in teaching a science *a sentence should never be memorized.* The language should always spring from the thought; that is, it should be an immediate necessity for the expression of the thought.

III. Incorrect habits or faults in expression (pronunciation, use of idioms, etc.) should be cured, first by an absolutely correct model of expression presented by the teacher; second, all mistakes should be corrected by the immediate presentation and repetition of the correct form, unless such correction obviously hinders

*It is not a matter of congratulation when a teacher is obliged to use any means, spelling book, text book, etc., when by enhanced skill, a higher and better means might be used. A teacher's skill equals the means he uses. A certain degree of teaching power *demands* a speller, and the memorizing of words.

the thinking of pupils. If a pupil has many faults, do not attempt to reform them all at once; take the most prominent first. A habit must be corrected by doing the right thing, and letting the wrong severely alone.

IV. Whenever any detail of grammatical construction is necessary to the clearer expression of thought, and at the same time to the evolution of thought—whether it be a rule, explanation, analysis or definition—*introduce it* and see thereafter that the pupils comply with the directions given.

V. In all modes of expression train pupils to use the shortest line of resistance, *i. e.*, the least possible physical effort consistent with the greatest audibility, intelligibility or legibility. All over-effort in speaking or writing adds to physical effort and absorbs mental power.

VI. *Never show a pupil a wrong form;* make all corrections by showing the absolutely accurate form.

VII. In all forms of expression train pupils into the habit of the strictest accuracy; never (with the exception III.) allow a pupil to use an incorrect form; never receive a paper upon which there is a single mistake in orthography, punctuation, use of capitals or syntax. Train pupils to know when *they do not know* a form, and train them to find the correct form before they attempt to write it. *Sinking correct expression into automatic action enhances the power of thought.* No

pains should be spared to attain this exceedingly important result.

The immense importance of reading and the study of books is self-evident. A few suggestions, however, may be made as to the use of reading and study. Reading is a process of arousing certain definite conscious activities by means of printed language. Study of books is precisely the same process with added intensity; this added intensity is produced by holding and reflecting upon the thoughts brought into consciousness by means of the printed words.

The value of reading and study depends, primarily, upon the kind and value of the conscious activities aroused by the words. The value of the conscious activities depends entirely upon the conformity of the thought to the immediate needs of growth. In these statements there is a sure and safe guide to teachers in the selection of topics for reading and study. A very important truth should also be borne in mind, to wit: all reading may be so selected as *to bear directly upon the organic growth of the body of knowledge or the science taught;* there need be very little pointless and useless reading. Observation, reading, study, molding, painting, drawing can and should be used in structural geography to build into the mind the general concepts corresponding to the general structure of the continent. A mature, well developed mind can form these valuable

concepts without the immediate aid of the related pictures of the land, clothed in the bright colors of vegetation, or the knowledge of the animals and races of men which use the structure for their homes, together with interesting accounts of travels, salient events of history and vivid description of scenery; but immature minds must have them to aid in the *in*formation of the fundamental concepts. So at every step descriptions of scenery, climate, animal and vegetable life, and the acts of men should be made to assist in the one purpose, which in after-study is to be the great basis of memory and the means of explanation. One line of reading has already been indicated, *i. e.*, reading which arouses and stimulates curiosity; the second line is that reading and study which induces the particularly required subjective condition of the mind. For both purposes the most careful selections should be made. Nothing should be read which does not interest or instruct.

Descriptions, travels, novels, poetry and history may be used with great profit in the study of geography to arouse curiosity and present conditions for growth in the subject. One very useful suggestion may here be added, to wit: each teacher should keep a carefully made up list of books and selections which have been of assistance in the study; the special topic and grade should be given in the record. One kind of reading

should be avoided; the reading which explains and defines those things which pupils properly taught can discover for themselves. The definition of a hill, river, cape or island, that has been or may be seen by the children, is a means of depriving them of the privilege of exercising their observing powers. Not long ago a teacher published a list of simple questions or problems in physical geography. Many letters were written inquiring "*where they could find the answers?*" The problems have but one purpose, and that, to stimulate original investigation, so as to lead to a clear knowledge of the conditions of physical action in earth, air and water. The mere memorizing of the answers would stimulate what? Superintendent Howland asked a grammar class in geography "how wide is a strait?" One pupil answered, hesitatingly, "About an inch," while another pupil, encouraged by a genial smile said, "It might be a foot wide." A memorized definition stood in the way of anything like a knowledge of reality.

Number and arithmetic are essential factors in teaching geography. The development of concepts of structure depends very largely upon ideas of distance, area and height, and the relation of these ideas each to the other and to all. These ideas are the products of that power of the mind which separates, combines and limits things by ones, the power of numbering. Distances, areas and heights are mentally measured by

standards of measurement fixed in the mind by observation. These standards of inch, foot, yard, rod, mile, etc., are the means by which unseen distances are imagined. When a natural feature, country or continent is being taught, measurements by these mental standards should be a prime factor in the development. At best, exact ideas of long distances and vast areas are impossible; they can be approximate only. Yet the only way of acquiring approximate ideas is by continually exercising the numbering power in its relations to the formation of concepts. The child's ideas of distance are exceedingly vague and indefinite; the *great* world to him is his immediate surroundings, the small one, that which lies outside of his sense-grasp; that world to the child is a matter of wonder and not of understanding. The measurement of the great world which lies beyond must be made by fixed ideas of distance, etc., acquired by actual experience.

Thus training in standards of measurement should form a permanent element in all school instruction. Measures of inch, foot, yard, rod, linear, square and cubic should early be taught by actual measurements made by pupils themselves on blackboards in school room, school house and out of doors. Pupils should be taught to measure by their steps: how many feet, yards, rods are there from your home to the school house? To such and such a house? *Judging* distances should be one im-

portant item; judging first and then testing the judgment by actually measuring. Comparison should early enter into the work. Which line is the longer? How much longer? Measure. Which area is the larger? How much larger? How much smaller? Measure. Pupils should have rulers ready for use. How high? How long? How wide? What is the area? are questions which should be closely connected with all investigations. Very much in the cultivation of ideas of distance may be done in field lessons; comparison of distances from one point to another; judging distances that pupils walk; journeys of pupils on the cars and otherwise may be used.

All maps drawn or molded should be made to a scale. When a pupil molds a river basin the questions should be asked: How long is your river basin? How wide? How high is the water-parting? How long is the river? How wide the right slope? The left slope? When the work of teaching scientific geography begins (the teaching of continents), lengths, breadths and areas of the continent, of river basins and other natural divisions should be carefully taught. Anything like the memorizing of figures which simply *represent* the distances *is worse than useless.* The *only* purpose of measurements is to realize approximately those elements of length and breadth so essential to the concepts of structure.

When approximate ideas of the area, including, of course, length, breadth and height, of one continent, have been acquired, this continent should be made the standard of measurement for all the other continents. The same can be said of natural divisions (river basins, etc.) and also political divisions. *Compare, compare, compare at every step.*

It will be readily seen what an essential means the countless problems of measurement and comparison in geography may be made to a mastery of the subject of arithmetic. If number were properly applied in developing ideas of extension, areas, solids, weight, force and values so necessary to the development of all subjects, the isolated teaching of arithmetic would be no longer a necessity.

The changes of the seasons and the phenomena of the countless changes in climate, vegetation and animal life present the most delightful and profitable means of teaching geography, in fact, in teaching all the natural sciences. The constant phenomena of climatic changes impinge upon all the senses of a child, producing feelings of both pleasure and pain. The first fall of snow is a joy forever to the child; the frost upon the windows, the ice forming upon the skating pond, the melting of snow, freshets, the ever-marvelous awakening from the death of winter to the life of spring, the first green shoots, the first pussy willows,

the first living insect, the migration of the birds, the first flower, the blossoming of fruit trees, one and all supply the richest and most abundant means of keeping in vigorous activity the spontaneous love and eager curiosity of children. Materials for new and interesting lessons are on every hand; rain, rain drops, clouds, mist, fog, frost, ice, uses of water, germination of seeds, growth of plants and countless matters of childish interest. The weather should be eagerly watched, the wind, direction, causes, cold, the sun, changes of position, slanting rays, changes at the equinoxes and solstices; the temperature should be studied by means of a thermometer; barometers should also be used. In the fourth grade weather reports in the newspapers should be read and studied. A snow storm may be used for delightful reading lessons; the words snow, white, falling, ground, flakes, etc., may be written upon the blackboard in appropriate sentences. The thought that the snow is a white blanket to cover the cold ground may be brought out. Stories of snow-capped mountains, countries covered by perpetual snow arouse the wonder and curiosity of children.

A rain storm or a shower may be the subject of close observation; the rain drops, the clouds, puddles of water, little streams newly formed, the wearing of the water present opportunities for the first lessons in erosion. The countless and marvelous changes from

the dead, snow-covered earth of winter to the living green of spring afford endless means for observation, investigation and study. Reading lessons, language, drawing, painting can be constantly used to enhance the intensity and steadiness of the observing powers.

Bring the child's heart close to the wonderful secrets of nature; cultivate the senses to the full, and in such a cultivation the sweetest, purest and holiest thoughts will be aroused and kept alive; habits of observation and investigation will be formed, which are essential factors in the soundest education. Such training makes pupils constant and continual students; they learn to study the everlasting problems of earth, air, water and sky, of life and growth which are ever before them. The child is a born naturalist, and blindness to the eternal truths of nature is a product of misdirected education.

Lessons in the changes that are involved in changing seasons should be begun in the lowest class and be continued throughout the entire course. The greatest care should be taken not to *force* observation or to draw inferences unsupported by facts discovered by the pupils.

Field lessons are an indispensable means in teaching geography. The principle by which concepts of structure that lie entirely beyond sense-grasp are formed in the mind has already been stated; the absolute dependence of the imagination or the powers of apper-

ception upon those concepts which come into the mind by observation, is probably the best known and the most undeniable fact in psychology. The strength of the activity in apperception depends mainly, if not wholly, upon the clear and vivid concepts gained by observation, and which, under the direction of the teacher, are to be blended and united into new wholes. The product of field lessons should be vivid pictures of natural features, and the solution of problems in relation to cause and effect which grow out of the conditions of natural features.

It is a very high test of the tact and skill of any teacher who can profitably manage a field lesson. Such tact consists chiefly in leading pupils to love observation and study better than play. The places for such visits should be carefully selected, places where certain natural features, needed for observation, are quite prominent.

Pupils should not always be told what to discover, that is, they should not be debarred from the privileges of original discovery. Establish some central point of observation and send pupils out to find things for themselves. A sketch book, a pile of sand to mold a hill in sight, etc., a shovel, a geological hammer would not come amiss. Distances and areas should be actually measured, and those which cannot be easily measured should be estimated. Vegetation, animals and facts in

political geography should come within the limits of observation.

In school again, the country and natural features observed should be molded in sand, drawn upon the blackboard and paper, and described both orally and in writing. Other natural features like those visited may be described by the teacher or in selected readings. The desire for new explorations may thus be increased.

Field lessons should be continued throughout the course; the scope of observations will be enlarged as the pupils' minds are properly developed.

In many localities the forms of land and water that make up the entire surface of the earth may be found; to study elementary geography in-doors seems an extravagant waste of time and power. Pupils generally have a large stock of scattered observations that may be brought together and related by field lessons.

From parts to the whole; from the whole to the parts; from particulars to generals; from generals to particulars are fundamental pedagogical principles of the first importance. The general process of teaching which leads to growth depends upon their application. These principles can be illustrated very clearly in geography. It is evident that any whole or object of thought *must be in consciousness before it can be described, analyzed or compared.* Judgment, analysis or comparison

of all objects, those within sense-grasp and those which lie beyond the sense-grasp depend absolutely and entirely upon the concepts in the mind which correspond to the objects—judged, analyzed or compared. Place an object before a child; his observation of that object is wholly limited to the concept brought into consciousness by the presence of the object. No matter how many attributes and relations of attributes the object may contain, it is the mental *correspondence*, and that correspondence alone upon which the mind can act. He really sees and hears only that of which he is conscious. This is just as true of products of apperception or imagination. The fundamental knowledge of geography consists of concepts of structure or those differentiations of surface that make up the character or organism of the continent or its natural parts. These concepts are products of that mental power called apperception. (Imagination, synthesis, association or recollection is the same power essentially under a different name.)

Apperception may be defined as that power which the mind has of blending, commingling, combining or uniting ideas, concepts or sense-products. This power makes new concepts out of old ones; out of concepts of hills, valleys, plains with their slopes a concept of a river basin; out of concepts of river basins and river basin systems a concept of a continent is formed; out of concepts of continents and oceans the concept

of the whole earth is formed. There can be no analysis, judgment or even inference made of, or concerning a whole unless that whole is a subject of thought —a concept in consciousness—and there can be no whole in the mind unless it is produced there, by a process of growth or evolution of parts into wholes. Fundamental growth consists of the synthesis of parts into wholes, facts into generalizations, elements into principles. This all-essential pedagogical principle, as has been already said, is fully illustrated by the process of the growth of a concept of a continent. A teacher who has the requisite knowledge and who closely and skillfully leads and watches the mental activities of his pupils will gain full proof of the mind's dependence in synthesis upon sense-products, and that synthetized wholes alone can be subjects of attention.

One of the most common and decidedly one of the greatest faults in all teaching is the fruitless attempt to *force pupils to think of concepts that are not in their minds.* Of course such a thing is utterly impossible; the worthless and even injurious outcome of such teaching is the memorizing of meaningless words, and a permanent dislike for the subject so mistaught. A thorough understanding on the part of teachers of this law of going from parts to wholes, from facts to generalizations would enable them to decide the much mooted question whether the initial step in geography should be the

whole round world, the *universe*, a continent, or objects that are or have been within the sense-grasp of the little beginners. What has a child in his consciousness when he is taught (*sic*) that the earth is a sphere? Something upon which his mental powers can act? Something corresponding to reality? Or merely a miniature globe?

The selection of facts, details and parts which are by mental combination to make up the general whole, is of the first importance, and in this selection is involved the question of what shall make the first general whole, *i. e.*, the first step in scientific geography. The latter question may be taken first. The imagined or apperceived wholes in geography are combinations of sense-products—direct results of sight and observation. This fact shows the necessity of field lessons, observations and study of the surrounding country. From the necessity for the study of immediate environment has sprung the very grave mistake of going from the observations thus acquired, to the study of the countries or land which lie just outside of the reach of sight, and then increasing the circle until it takes in the whole country or continent. There are two undeniable proofs of this error; first, mere spacial proximity has nothing whatever to do with the powers of a pupil to imagine the structure of a country that lies beyond his observation—Italy, Greece, Egypt or Palestine can be imag-

ined as easily as the adjacent country, and indeed much more easily than most countries, as the structures of these regions are very simple; second, the plain rule or procedure in going from the part to the whole is to form a real whole that can be the most easily imagined or apperceived. All attempts at complexity should be avoided; the simplest general whole should be the first objective point. This simple whole is first found in the river basin and second in the continent, each made up of simple slopes, constituting an organism for life. The next county, or the State in which one lives, is in structure far more complex; far more difficult to imagine than an entire continent, just as the anatomy of a finger or a muscle is more difficult than the anatomy of the entire framework of the body. Two great slopes, two great land masses, each with two slopes, all including four great river basins and four river basin systems, make up the simple framework of North America. In this simple concept may be found by study and analysis countless modifications, an immense complexity, but these modifications of slopes and combined slopes should be found *inside* of the general whole, for any attempt to go from *all* the parts to a complete whole is injurious to growth. This leads to the discussion of the first question, the question of the selection of details, which will make up the general whole.

It will be seen at once that geography is full of innumerable details, countless facts, all of which may be interesting and ofttimes fascinating to the close student. The chief danger to the teacher who is really trying to teach scientifically is the attempt to teach a multiplicity of details, details that form no part of the first (to the learner) general whole, *and which actually obstruct, if not entirely prevent, his power to generalize.* This fact has a complete illustration in a way of teaching all too common in schools. First a glance at the whole world, with zones and meridians (bounding what?); then a dash of observation, followed by the *political* geography of a county; then the state; then groups of states; teaching the United States follows, and at last encumbered by an ocean of details the continent becomes the object of thought. This seems to be the exact reverse of natural teaching.*

It accounts for the prolonged and ofttimes ineffectual struggle pupils have, who have been the victims of such a course, to use their imaginations in the formation of a general whole. This is also just as true of all other subjects of study as it is of geography; the fatal mistake of many teachers, and especially of specialists in education, is to lead their pupils into the search for (to the teachers) alluring details instead of

*By *natural* teaching is meant that teaching which presents the conditions adapted and conforming to the laws of *human* growth.

teaching just enough of facts for the purposes of clear and simple generalizations.

The natural process of going from particulars to generals arouses a spontaneous energy as strongly acting in the child as in the man; when the child classifies a rose or animal he does it by means of this ever-acting power. The tendency of the mind, when a whole is formed, is to turn upon that whole and *analyze* it—that is, to distinctly cognize the parts of the whole, and cognize the relations of each part or element to the whole. Comparison is a mode of analysis, and the special function of analysis is to reinforce synthesis. The more active the analytic power is the stronger the synthetic power will become *if the parts or elements are related to the general whole.* Into the clear, simple, general whole of the concept of a continent and of the world will come by proper study the countless details, modifications of structure; river basins will spring up within river basins, slopes within slopes, political divisions, states, cities and their boundaries will be related in their proper positions to the general whole. Modifications, changes, events in history, current news will all have a place in the mind, fixed in the memory, by logical association. *This is the true cultivation of the philosophic memory, which is identical with mind development.*

Concentration. A cursory reading of this book might lead to the judgment that its tendency conflicts with the doctrines laid down in the preceding section; that is, so many details presented for study might lead to hopeless confusion rather than to clearness of thought and compactness of knowledge. Many teachers will doubtless feel that it is impossible to teach so much in so short a time, this work taking its due proportion of time with other studies. It is readily granted that looking at the manifold subjects of study from the standpoint of isolation or the non-relation of one subject to all the others would cause an emotion akin to despair, especially if a written examination upon the facts (?) learned were to follow; but from the standpoint of unity, of growth, there is much to hope.

The purpose in teaching geography is to build in the mind a symmetrical organic body of knowledge—knowledge which is power. Teaching is the presentation of external conditions for the development of this power. The conditions in each and all stages and under all mental conditions should be adapted to the end in view. No means, however full the course of study may be, should be used that is not an economy in the development of power; the final selection of means should always remain with the teacher, but the teacher, in turn, should use all the necessary means he can find, and the finding of better means is endless. There is

no such thing as *grade* in the art of teaching; the lowest primary teacher should have just as much knowledge of a subject which she begins to teach as the teacher of the highest grade who finishes (?) the subject. Otherwise the teacher is an artisan and not an architect or an artist; the teacher must know the general whole before she can properly teach a part. A thorough knowledge of the importance of essential details and a full comprehension of the right ideal enlarge the dignity of the teacher. Present good is everlasting good, and everything *which ought to be taught* should be fixed in the mind forever. The main question is not one of *time*, but of *growth*, and growth of soul is eternal.

Form, color and number constitute a powerful trinity of means in growth; they enter essentially into all geographical teaching; they do not take time *away* from geographical teaching; they are necessities *in* the teaching. If properly understood and skillfully handled nearly all of arithmetic could be taught in teaching geography, and every problem in number would enhance the value of the main thought.

Observation, hearing language and reading (including study of books) are the main processes of thought evolution. One can easily understand that countless opportunities are presented for training the senses in teaching geography, that subjects and objects

for oral and object teaching are without limit in this and cognate subjects. Reading can always be used for the study of subjects, and not merely for exercise in reading, and a proper share should be given to geography. Thus these three main processes of thought need not take one minute of time outside of their use in teaching the principal branches. The function of expression, whatever mode is employed, oral or written, drawing, painting or modeling, is to compact and intensify thought. Each mode has some special and separate function for which no other mode can become a substitute. Each mode, too, is an absolute necessity to the study of geography. Oral language with all its accidents—grammatical construction (as has been shown under language), may be thoroughly taught in teaching geography. The same can be said of the written language including penmanship and spelling. The functions of drawing and painting have been elsewhere described. There is no doubt that if all these modes of expression are properly used in teaching geography the acquirement of good technical skill and accuracy would be a secondary but very important result. Under these conditions, and used for the teaching of all subjects, training in the modes of expression, instead of taking extra time, *would save very much time.* Not too many studies, but too little genuine teaching is the trouble. All sciences grow naturally out of geog-

raphy. Structure is the primary teaching of geology, geology of mineralogy; problems in physics or chemistry present themselves wherever motion is observed; botany grows out of the study of soil and drainage; zoology and its kindred sciences follow, to be followed in turn by the highest of sciences, that of man and his history; thus there is but one science, the science of life, the science of organic matter explained by the inorganic. Concentration is co-ordination of all kindred subjects into one subject; it consists in the development of form, color and number, essential factors in all subjects; it uses continually the same process of mental evolution induced by oral or written language, drawing, painting or modeling; it turns each and all modes of thought-expression directly back upon the development of thought power, employing the function of a mode of expression whenever that mode enhances the strength of conscious activities. There are more opportunities for skill-acquisition in this direction than any other; it requires, however, the keenest discernment to know just what is needed and all that is needed to awaken, stimulate and guide the growing faculties.

NOTES ON THE COURSE OF STUDY.

FIRST GRADE.

Color. The power to see colors and to discriminate between colors is best acquired by painting. A little box of water colors may be used for this purpose. Painting should be done *without first outlining.* Pupils should be trained to mix paints and adapt the colors to the colors which they are representing. Objects used in teaching natural sciences should be painted, such as leaves, fruits, flowers, seeds, nuts and animals. The first attempts will be exceedingly crude; the line of criticism should be to lead a pupil to notice the most prominent defect in his work and change that; follow this plan steadily; remember that better painting means *better and closer observation.* Birds as they appear in the spring may be painted from stuffed specimens. Do not be afraid of great crudeness; and be very careful not to discourage any *attempts* on the part of your pupils. Encourage effort, and let results take care of themselves.

Form. The best way to teach form is by modeling in clay. Model natural forms first—apples, peaches, plums, nuts, pears, potatoes, turnips, beets, etc. Plaques of leaves, flowers and animals may be modeled.

The lessons in form should be so directed as to lead up to the typical, *i. e.*, sphere, cylinder, cube, etc. The line of criticism should be the same as in painting; bear patiently with the most awkward attempts, and suggest changes in the most glaring defect.

Little models of hills may be made. Common potters' or kindergarten clay may be obtained for one cent and a half a pound. Keep the clay *continually moist.* This may be done by putting wet cloths over it. The same clay may be used repeatedly by soaking it.

A sand table might be profitably used. This is a very old device. A long table with raised edges and filled with foundry or clean white sand. Hills, valleys, houses, etc., may be molded upon this at will by the children.

Drawing. Pupils may be led to make crude attempts to illustrate, on the blackboard, the stories told them. They should illustrate their number lessons within proper limits.

Number. All objects modeled, painted, described or drawn should be measured. Lessons in distance and area should be given by lines, squares and oblongs upon the blackboard. For example, draw upon the board a line six inches long.

a *c* *b*

How far is it from *a* to *b*? Measure and see if you are right. How far is it from *a* to *c*, one-half the

distance from *a* to *b*? How many inches are there from *c* to *b*? If a snail crawls three inches in an hour, how long would it take him to crawl from *a* to *c*? From *c* to *b*? From *a* to *b*? The same and similar questions may be asked concerning feet, yards and rods, linear, square and cubical. Distances and areas should be estimated in the school-room and in the school-yard, and these measured to verify the estimates.

Direction. Train pupils to know the points of the compass, and to point toward the North, South, East and West in the school-room, the school-yard and at home.

Observations of the weather and changes of seasons. Advantage should be taken of showers, storms, of rain and snow, cold and warm days, days of bright sunshine and cloudy days. A short time, each session, should be devoted to a conversation about the weather. Teachers would do well to keep a record of the answers of their pupils. Where does the rain come from? What are the clouds? Of what color are the clouds? What color is the sky? The sun? The moon? The stars? Where does the rain go? What is ice? What are the uses of ice? What makes it warm? Cold? Where does the sun rise? Where does it set? What part of the day is the sun the highest? What makes it dark? What is water good for? All explanations on the part of the teacher should have the effect of arousing the

eager curiosity of pupils. Be careful not to give too many explanations.

Growth of plants. Examine seeds, paint and mold them; have pupils plant in sand, loam, cotton in water, thick brown paper kept damp, and then watch their germination and growth. Paint the leaves, buds and roots as they grow. Lead pupils to watch eagerly all changes in growth. Observe changes in vegetation outside of the school-room. Have pupils collect specimens of leaves, flowers, roots, etc. Remember the main purpose of this work is to lead to a great love for investigation and to make them careful observers.

Animals. Begin with live animals, and then use skins of animals or stuffed animals. Have no set forms of lessons or make up your mind that children *must* observe certain things. Aid your pupils to observe and then follow the course of their observations, rather than fixing a line for them to follow. Have pupils make collections of insects; collect cocoons, paint them, and then lead pupils to watch the metamorphoses into moths and butterflies. Lessons on animals should be confined in primary grades to: (1) Form; (2) Habits; (3) Food; (4) Houses, nests, dens, etc; (5) Young and care of young; (6) Adaptation of body to life, *i. e.*, teeth for gnawing, feet for swimming, etc.; (7) Covering, as fur, feathers for protection from cold, or defense against enemies.

Fairy tales. Tell pupils a fairy tale at least once a week. Have them tell you the story, using their own language. Illustrate the stories by drawings on the blackboard.

Reading and language. All reading lessons and all the cultivation of oral and written language may spring from the lessons above suggested in this course. In fact, the lessons in reading may and should be made the essential means of teaching the subjects suggested, and not the subjects the means of teaching the language. Every new word that the children use should be immediately written upon the blackboard; it should also be written upon a slip of paper and go into the child's dictionary.*

SECOND GRADE.

Continue the observation lessons and practice in the acquisition of technical skill begun in the first grade.

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* The child's dictionary is a device to assist children in helping themselves to the use of all the words they are learning. These words are distinctly written by the teacher on slips of stiff paper or cardboard, and put in order on a framework of wire (a frame used by merchants for business cards). When a child wishes to use a word in writing, he goes to the "dictionary," finds and uses it. In the second and third grades, these words and all new ones are written in a blank book and arranged in alphabetical order. No word is put into the dictionary unless it is needed by the class. In the fourth grade, a real dictionary may be used. The answers of the children may be written upon the board, and then read by the class. While giving any lesson the teacher writes part of the story on the board, Intense desire on the part of children to know words is the one great secret of learning to read rapidly and correctly.

Color and drawing. The painting should be continued. Careful, steady criticism should lead children to closer and closer observation. A test of the influence of painting is the power to draw outlines of objects. Just as soon as a pupil can draw an outline of an object, regular training in drawing should begin. Continue illustrations of stories.

Number, form and distance. Draw and estimate distances and areas both in and out of doors. Draw little maps illustrating scenes of stories, and estimate distances in maps. Model typical forms, sphere, cylinder, cube, etc. Have pupils describe the forms that they model.

Use sand in molding hills, valleys, etc.

Draw plan of school-room.

Locate streets and houses in the vicinity.

Lessons upon sky, horizon, zenith, vertical, horizontal and curved lines.

Changes of seasons. In addition to former observations, observe winds, direction of winds, sunlight, shadows, movement of the sun. Draw a line on the floor where the sun's rays fall at a certain time in the day, and have pupils notice the changes in succeeding days. Follow closely the changes from autumn to winter, and from winter to spring.

Vegetation. Plant seeds as in the first grade. Observe plants and trees in the surrounding country.

Begin field lessons. Name the trees; teach pupils to distinguish them. Compare their leaves and barks. Take impressions of leaves upon plaques of clay. Draw the trees.

Have lessons upon fruits and valuable seeds—wheat, rye, rice, barley, coffee, etc. Draw a plan of a garden and locate different plants; let each originate and draw his own plan, estimating distances and area, giving space for flowers, vegetables, etc.

Animals. Lessons upon animals, forms, structure, fur or feathers; use of animals; food. Collect insects. Observe birds, migration, nests, eggs, etc.

Teach pupils how animals make their houses, dens, nests and other places of abode.

Tell pupils and have read stories about animals. Model animals in clay; paint and draw them.

Fairy tales. Continue the course in carefully selected fairy stories, drawing, illustrating and indicating localities by maps. Have pupils read stories from books as soon as possible.

Reading and language. Select the reading just as far as possible in connection with the subjects taught. Continue blackboard reading, making lessons about plants, animals, etc. Books recommended for this grade:

"Classics for Children"—A Primer: Ginn & Co.

"Stories for Kindergartens and Primary Schools:" Ginn & Co.

"The Book of Folk Stories:" Houghton, Mifflin & Co.

THIRD GRADE.

Review the work of previous grades and continue the different lines of observation and study.

Geography in connection with history. History is begun in this grade with descriptions of the *homes,* lives and habits of barbarous tribes. The Eskimos is the first subject; a map of the country where they live may be drawn. A globe may be presented and the cold North pointed out. Eskimo houses described, drawn and molded in clay or sand; cooking utensils, boats, weapons, food, clothing, animals they hunt, habits and customs. Read "Seven Little Sisters:" Lee & Shepard.

Soils. Lessons on pebbles, gravel, sand, clay, loam and rocks. Have pupils collect specimens of each kind of soil. Observe soils in field lessons. Find uses of the different kinds of soils. Give object lessons in the common minerals; teach pupils to distinguish them.

Forms of water. Steam, mist, fog, vapor, clouds, ice, hail, snow, dew, frost; find the uses of each form, and how the changes take place from one form to the other.

Observe the use of water in the nourishment of plants; what does water carry up into plants to make them grow; how different kinds of sap taste.

Simple lessons in heat, cold, air and the movements of air.

Each day have a short conversation upon the changes of weather; rain, snow, sunshine, etc. Have pupils notice the changes in the lengths of shadows; the changes of sunlight upon the school-room floor.

Locate places mentioned in stories, read or told. Field lessons in hills, valleys, brooks, ponds and rivers. Draw, mold, describe, orally and by writing.

Continue lessons on plants and animals. Read stories of animals and describe their homes.

Read Johonnot's book of "Cats and Dogs:" Appleton.

Mrs. Tenney's "Pictures and Stories of Animals:" Lee & Shepard.

"Book of Fables:" Houghton, Mifflin & Co.

Stories of Animals in "Munroe's Second Reader:" Cowperthwait.

Lessons upon common articles of food, preparation for cooking and process of cooking—corn, wheat, potatoes, coffee, rye, barley, milk, butter, cheese, meats, etc. Read "Aunt Martha's Corner Cupboard."

Lessons upon articles of clothing; material, preparation, manufacture; cotton, wool, flax, skins of animals.

In all these lessons the *greatest care* should be taken with the language of pupils, both oral and written. *Never allow a pupil to make a single mistake in writing.* Remember that the habit of accuracy is a great saving of time and power; no matter how much time it takes to cultivate it, it is time saved in the end. All writing should be done with pens.*

FOURTH GRADE.

With this grade a more systematic study of geography is begun. The mental material is to be prepared for the apperception of the concept of a continent by the careful observation and study of the natural features and elements of land and water. This preparation should be done with the greatest care, because upon it depends the power to imagine the continents. *All previous work is to be continued.* Lessons upon color, form, number, changes of seasons, plants and animals should become more and more systematic. The mental growth of pupils in these subjects should be closely watched, and new conditions presented which are adapted to their enhanced mental powers. There does not seem to be any logical reason why one natural feature should be the first object, rather than another. The rule is to take first the most prominent, and the

*Pupils should not be allowed to write with pencil and then copy their work. Have pupils write a very little at a time, and write often.

most easily accessible natural feature first, whether it be a hill, mountain, plain, valley or river. The proper observation of any one form of surface will lead to the study of all the others. The general directions for the teaching of a hill or any other natural feature are the same as the teaching of a plant, animal or mineral; the substantial acquisitions are the results of close observation.* Field lessons should be a principal factor in the teaching. At least once a week the class should visit some place, where profitable observations and investigations may be made.

Molding in sand, painting, drawing, oral and written descriptions should be used continually in the development of concepts. The best sand to use may be procured at any foundry, where it is used in molding. This sand should be kept moist and well stirred up and well granulated so that it can be easily worked. Common beach sand may be used; indeed, any kind of loam. There is no excuse whatever for neglect to use this very cheap and useful means.

A sand or molding-table may be easily made. A board three by four, or four by five, with raised edges, fixed with hinges upon a table just high enough for pupils is, perhaps, the simplest molding-table. The best kind of a molding-table in use, is a table, made for

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*Do not try to have pupils see too much. Follow them and not oblige them to follow you.

the purpose, with a deep drawer for sand, and arranged with hinges so that the board which forms the top of the table may be raised lengthwise, and sidewise. Shallow, flat pans, twelve by twenty inches, made of tin or galvanized iron, or boards with raised edges (such pans cost not more than twenty cents each) may be made so that each pupil can have one. If the school-yard is large enough, a load of white sand may be profitably used in molding natural features. Potters' clay and putty may be used for the same purpose.

Suggestions for Elementary Lessons in Observation or Field Lessons.

NATURAL FEATURES OF LAND.

TO BE OBSERVED.	*TO BE DESCRIBED ORALLY, READ IN BOOKS AND ILLUSTRATED BY PICTURES.
1. Hills—	1. Mountains—
a Forms of.	*a* Forms.
b Summit, top.	*b* Volcanoes.
c Base.	*c* Snow and ice upon glaciers.
d Foot.	*d* Vegetation.
e Bottom.	*e* Animals.
f Slopes.	

* The advantages for observations differ so in different localities that it is, of course, impossible to make anything like a correct classification of objects to be observed and objects to be described by the teacher.

g Causes of hills.
h Materials of which hills are made.
i Uses of hills.
j Hills of different shapes.
k Cliffs, bluffs, made by erosion.

2. CHAINS OF HILLS—

a Forms of.
b Ranges.
c Ridges.
d Combs.
e Crests.
f Passes.
g Slopes.
h Plateaus.
i Terraces.
j Causes of.
k Materials.
l Uses.
m Drainage.
n Washing of soil for land below.
o Health, purer air on heights.

f Peaks.
g Precipices.
h Upheaval.
i Materials.
j Uses.
k Show pictures of, and describe a few high mountains.

2. SYSTEMS OF MOUNTAINS—

a Chains.
b Ranges.
c Sierras and Cordilleras.
d Slopes.
e Plateaus.
f Passes, gaps, and gorges.
g Ravines.
h Canons.
i Snow.
j Glaciers.
k Cold heights.
l Water partings.
m Clouds, condensation of vapor.
n Materials.
o Uses.

p Outlook.

3. Gradual Slopes—

a Plains.

b Valleys.

c Prairies.

d Marshes.

e Bogs.

f Swamps.

g How swamps are made.

h Water flows slowly through lowlands.

i How wet lands are drained.

j Swamps become firm land naturally.

p Describe, mold and show pictures of the Rocky Mountains, Andes, Alps and Himalayas.

3. Great Plains—

a Prairies.

b Steppes.

c Savannahs.

d Forests.

e Grassy plains.

f Deserts.

g Great valleys.

h Causes and uses.

i Describe the three great plains of the world, in South America, North America and Eurasia.

DRAINAGE.

1. Forms of Surface Water—

a Rivers.

b Brooks.

c Creeks.

d Sources.

1. Bodies of Water—

a Rivers.

b Lakes.

c *Amazon, Mississippi, Nile.*

e Springs.
f Ponds.
g Lakes.
h Channels.
i Currents.
j Banks.
k Beds.
l Windings.
m Islands in.
n Tributaries.
o Branches.
p Rapids.
q Waterfalls.
r Causes of.
s Uses of.

d Underground reservoirs
e Intermittent springs.
f Caves, *Mammoth.*
g Artesian wells, Petroleum and Gas wells.
h Artificial drainage.
i Tiles, ditches.
j Artificial irrigation.
k Canals.
l Rivers for manufactures, *Merrimack.*
m For commerce, *Mississippi, Volga.*
n For irrigation, *Nile, La Platte, San Joaquin, Amoo Daria.*
o Causes and uses.

2. River Basins—

a Slopes that form.
b Right slope.
c Left slope.
d Meeting of slopes at their lower edges.
e Water parting.
f Mouth of river.
g Source slope.

2. River Basins—

Describe basins of the
a *Mississippi,* with its prairies and mountains.
b *Amazon* with its selvas.
c *La Platte,* pampas.
d *Orinoco,* llanos.
e *Po,* Alps and Delta.

h Causes of—
Size of river.
Length.
Rapidity of current.
Windings.
Banks.
Width.
Depth.
Silt in river.
Delta.

i Uses of river basins.

j Uses of river.

k Causes of ponds, lakes, marshes, swamps in river basin.

l Reservoirs of rivers—
Surface waters, forms of; water under the surface; ice and snow.

m Basins of tributaries.

f *Indus, Ganges,* plains, deltas, Himalayas.

g *Colorado,* canons.

h *Danube* and *Magdalena,* mountainous basins.

i *Nile,* bearing soil to the plains of Egypt.

j Uses of river basins for building railroads.

k Freshets and floods.

l Soil of river basins.

m Boundaries of river basins.

n Great lake basins, *St. Lawrence, Reservoirs of the Nile.*

o Uses of water in soil; relation to vegetation, sap, minerals in water, blood of plants.

3. Coast Lines—

a Shores.

b Coasts.

c Beaches.

d Cliffs.

e Crags.

3. Relations of Bodies of Water to Bodies of Land—

a Oceans.

b Waves.

c Tides.

d Ocean currents.

e Wearing coast.

f *Projections.*
g Peninsulas.
h Promontories.
i Capes.
Points.
k Islands broken off from peninsulas.
l *Indentations.*
m Bays.
n Gulfs.
o Seas.
p Harbors.
q Inlets.
r Estuaries.
s Mouths of rivers.
t Deltas.
u Causes of all these forms.
v Uses of.
w Regular coast lines.
x Irregular coast lines.
y Relations of hills and mountains to coast lines.

f Building coasts, *Atlantic coast of North America.*
g Ice bound coasts.
h Effect of winds on coasts; *sand dunes.*
i Description of beaches, cliffs.
j Peninsulas of *Italy, Scandinavia, Greece, Spain, India, Arabia, Malay*, peculiar forms of.
k Continental Islands, *Great Britain, Japan Islands, Madagascar.*
l Oceanic Islands, *Atolls, Coral Islands, Florida.*
m Describe some good harbors. Protection from ocean.
n Harbors on building coasts.
o Deltas of the *Mississippi, Po, Ganges, Hoang Ho.*
p Describe *Mediterranean*

Sea, Red Sea, Bering Strait, Isthmus of Darien, Suez.

4. Erosion, Wearing and Building.

a Streets, roads and fields after a shower or rain storm.

b Puddles.

c Streams.

d Cutting or wearing of running water.

e Silt the water carries.

f Spreading out of sediment.

g How pebbles are made; history of a pebble.

h Different effects of running water upon hard and soft soil.

i Causes of river channels.

j River beds.

k Banks.

l When and where does water carry silt?

m When and where does

4. Erosion and Formation of Land.

a Forces at work abrading rock and soil, carrying and spreading it out.

b Rivers and brooks cutting their channel (vertically).

c Rivers cutting bottom lands by slowly swinging (in centuries) from side to side, horizontally.

d Bluffs far removed from river, formerly the banks of the river.

e Land formed by silt deltas, sand bars, alluvial soil.

f Action of the wind in forming land—sand dunes, snow drifts.

g Action of the wind in

it deposit silt?

n Causes of sand bars.

o Causes of deltas.

p Of rapids and waterfalls.

q What forces, besides water, break up rocks and soil?

r River dams, effects of.

s What land furnishes a river with silt?

erosion, buttes.

h Niagara Falls, Zambesi river, Colorado canons.

i Nile, making rich land out of a desert.

j Amoo Daria, Po, Hoang-Ho.

k Continents wearing away and lifted up.

t Causes and uses of all these forms.

Lessons Upon Occupations.

a Agriculture.

b Manufacture.

c Commerce.

d Grazing.

Lessons upon the main products of agriculture—cotton, sugar, rice, grapevine, palms, bamboo, coffee-plant, tea-plant. History of a breakfast, Swinton's Primary Geography.

Lessons upon building and use of railroads; upon ships and their uses.

Lessons upon useful animals; animals used for food—cattle, sheep, etc. Animals used for transportation—horses, camels, elephant, llama. Domestic animals—dog, cat, etc.

This schedule presents a formidable array of work if teachers were expected to teach something definite and particular about each subject, and especially if the teaching is to be followed by a fixed examination. This plan is intended to suggest means of teaching; to give objects for observation and subjects which may be described. It is proposed as a beginning of a systematic teaching of geography, and the objects and subjects are to be continued throughout the course. The demand for observation and inference should always be commensurate with the pupil's powers. Descriptions, by reading or by the teacher, should only be given as they stimulate curiosity and arouse interest. Under these considerations there is no danger of over-crowding.

Plan of lessons upon hills. We will suppose that the pupils have had a "field lesson" upon a hill or hills.

1. Have pupils take their molding pans and mold the hill, each pupil expressing his own thought.

Let pupils criticise each others, work. How high is the hill? How long? Describe the hill. Let the teacher draw a profile of the hill on the board. What do you call this part (pointing to summit)? What other name? What did you see from the top of the hill? What part is this (pointing to base)? What other name? (foot, bottom.) What do you find between the summit and base? How many slopes has this hill? What kind

of slopes has this hill, steep, abrupt, gradual? Grade of inclination? The words *height, elevation, altitudes, ascent, descent, acclivity, declivity, depression,* may be introduced in descriptions. Have pupils draw a profile of the hill. Have them draw a map of the hill with a little of the surrounding country. Write all new words upon the board, and have pupils write a description of the hill. Have pupils tell all the uses of the hill; coast on, etc. Describe the vegetation of the hill, and the minerals that they have found. Observe horizon from the foot and then from the top of the hill. Draw circles representing the larger and smaller horizon.

What to tell and what to read. When pupils are interested in describing the results of their observations lead them to tell of other hills and landscapes they have seen in travels. Tell them of hills and mountains you have seen. How high is this hill? One hundred feet? How high would it be, if it were twice as high as it is now? Three times? Ten times? Twenty times? Draw to a scale on the black-board. There are mountains that reach away above the clouds. If you were on one you could see the clouds beneath your feet. When it lightened you would see the flash below you. The tops of high mountains are very cold. Why are they cold? They are nearer the sun than you are. On the summits of some mountains there is ice and snow all the time, and on some mountains there are *rivers of ice.*

Rivers of ice are called *glaciers.* Some glaciers are found in the United States. Where? There is a curious way of telling how high mountains are. Here is the instrument (showing barometer) with which elevations are measured. How do you think it is done? I am told that beans cannot be boiled upon the summits of very high mountains. Why? When people go up in a balloon they find it very cold. Why? What is a cloud? What makes clouds move? Draw profile of a mountain and a cloud near the top. Did you ever see, on a hot day, a pitcher with ice-water in it? What were on the outside of the pitcher? Where did the drops come from? Is there water in this air? How is the water in the air changed so that you can see it? How is the vapor in the air changed to drops of water? Now, if the clouds, which you can see, which are composed of vapor, were driven (what would drive them?) over this mountain (pointing to profile), what would happen? Where would the rain go? Upon which side of the mountain would it fall? What is the difference between rain and snow? Rain and hail? When is vapor frozen into snow? When is rain frozen into hail? Why do people climb high mountains? What are the dangers in climbing high mountains? Tell a story of travelers in the Alps or Andes. Some persons cannot ascend very high mountains because the blood rushes to their faces and sometimes comes through

the skin. Why? What difference, except difference in warmth, is there in the air on mountains and the air on low plains? Why is the air lighter on mountain tops? Do not answer these questions for pupils, but let them try to discover the reasons.

Pictures of scenery should be used in connection with these lessons. Pictures may be cut from illustrated papers and mounted on cardboard. Teachers can easily procure a large number of them. Show pictures of hills and mountains in connection with lessons upon them; have pupils describe the pictures orally and in writing. D. C. Heath & Co. furnish Shaler's geological models and pictures, showing the effects of erosion; they are excellent for the study of changes in the earth's surface.

Hill and plain. After a field lesson have pupils mold and draw a hill or several hills (a chain), sloping down into a plain. Draw a profile of a hill and plain. What kind of a slope is this (pointing to slope of hill)? An abrupt slope; a steep slope. What do you think the angle of inclination is? (Pupils should be taught about angles in lessons upon form.)

Which is the greater angle (pointing to the other side of the hill)? Where does this slope stop (pointing to the side of hill toward the plain)? Does it stop at the foot of the hill? Is the surface of the plain

level? What is the difference between the slope of the plain and the slope of the hill? What would be the result if the plain were level, that is, did not slope at all? What if the surface of the earth were level and there were no hills or slopes? Lead pupils to see that one of the principal uses of slopes is to drain the land. Where does the water go when it falls from the clouds? Where does the water go that does not run off on the top or surface of the ground? How far down does the water go? When does it stop in the ground? Where does it go then? Where does it come out of the ground? What is the water called where it runs out of the ground? Why does it run out? What are mineral springs? Why does some water have salt in it? Sulphur? Iron? What is the color of water that has much iron in it? What is a well? How are wells made? What is the use of a well? What is the difference between a spring and a well? Tell pupils about artesian wells. In the Santa Clara valley, California, the farmers bore deep artesian wells to water the land. There is very little rain, and they could not raise crops, you know, without water. Why? Every morning the water rises in the wells to the tops, and then overflows. The water flows softly over the land and gives the thirsty plants plenty of water. Then the water goes down in the wells, and does not rise until early the next morning. How does the water come to these wells when there

is no rain? There are high mountains all around the Santa Clara valley. When land is watered in this way it is called artificial *irrigation.* Some farmers say that they like irrigation better than rain; would you? Why? Why do you think some farmers like it better than rain? When we study river basins we shall learn how rivers are used to irrigate land. I must tell you about the Desert of Sahara; what is a desert? This desert is a vast extent of land upon which no rain falls (why?); there are great piles, hills and mountains of sand, and hills and mountains of rock; the sand is constantly moving. What moves the sand? Travelers are obliged to cross this desert. What is the name of the desert? (write the name.) In some places in this great desert there are green places; green grass and palm trees. What makes such places green? Where does the water come from? What is the name of the place in the desert where there is water and green grass? Oasis. How do you think the water comes to an oasis when there is no rain? Travelers, with great loads of merchandise to sell, travel across this desert. What carry the loads of merchandise? Ships. Real ships cannot sail on the sand. What kind of ships do you suppose they are? Ships of the desert they are called. Here is a picture of one (showing a picture of a camel.) Why do these travelers use camels to cross the desert? Tell them how and why a camel can go so long without

water. Some men have bored artesian wells in this great desert, and the water gushing out has made—what? An artificial oasis. Where did the water come from?

Use of water in the soil. What are pebbles? What is gravel? What is sand? Loam? Clay? How are soils made? All soils are made of abraded or ground-up rock. What is vegetable mold? Tell pupils about the glaciers and how they grind up rocks; how they break off boulders from mountains; how these great ice rivers carry and deposit them in the plains below. Get pupils to tell you of all the ways earth and rocks are moved by natural forces; ice, frost, air, winds, rivers, rains, etc. What would you find underneath the soil if you should dig down? Did you ever see places where men had dug right through hills? Railroad cuts. The rocks form the bones or framework of the earth. What is the flesh? What the blood? Where it rains, you say, some of the water runs off on the surface, and some goes down into the ground. What if the top of the ground, or the surface, were hard as steel, where would all the water go then? None would go down into the earth or soil; it would all run off. What good does the water do in the ground? How do plants take up water? How should begin the study of the wonders of plant hairs, and how they take in water. Does water nourish plants? Why? Why

not? What is the water in plants called? How many kinds of sap have you ever seen? What is done with the sap of maple trees? Where does the sugar come from? Is it a part of the water? Have you ever tasted bitter sap? Why do some plant hairs or rootlets take up sweet sap, and some plants bitter sap? How do the roots know what kind of sap to take up? Lead pupils to know that the water, as it creeps through the soil down a slope, takes little particles of minerals with it, and carries these particles to the plant hairs; these hairs take just what they need for the growth of the particular tree to which they belong. Some plants grow in water; (what plants?) Can all plants grow in water? Why not? Does the water make the plants which live in it grow? How are plants made to grow well in a garden? What does your father put on the ground to make plants grow?

What kind of plants grow in marshy places? What is a marsh? What kind of plants grow in rich black soil? In sandy soil? What is poor soil? What is fertile soil? When do farmers and gardeners put fertilizers upon land? Take a California Resurrection Plant that is to all appearance dead and dried up; put it in a saucer of water after your pupils have carefully observed it; then let them watch the wonderful process of its coming to life. After it has become green take it out and let it dry. When the pupils' curiosity has

been fully aroused, let them plant seeds in different kinds of soils and watch the changes. In connection with the nourishment of plants by mineral substances, lead pupils to discover the use of air to plants; how plants breathe. Leaves are the lungs of a plant or tree. Explain.

River basins. The formation of a clear concept of a river basin is of very great importance. It is the organized unit of drainage. In it may be found chains of hills and mountains, plains, and all the surface forms which constitute a continent. Next to the analysis of large slopes the division of a continent into river basins is the simplest and easiest; *it explains the organism of a continent.* After lessons have been carefully given upon hills, plains, mountains, slopes, etc., the river basin should be taught. There are many ways of beginning this work; the plan here suggested may be far from the best one.

What is a river? How large is any river that you have ever seen? How wide is it? Where does the water come from that makes the river? Springs, branches, tributaries, ponds, lakes. Where does the water come from that makes a spring? A tributary? A pond or lake? Question pupils so that they will discover that the main reservoir is the soil or land; that the water percolates through the soil, and that it comes to the surface when a hard strata of rock or soil crops

out, or comes out of the ground. From how much land does a river receive water? How much land does a river drain? When the rain ceases to fall on the land, why does not the river dry up? Where does a river get its water during a long drought? Some brooks and some rivers do dry up. The land which a river drains is called a river basin. How large is a river basin? Where does the water begin to flow toward a river? What causes water to flow toward a river? From how many places does water begin to flow toward a river? Take your pans and mold a river basin. Show me how much land a river drains. Show me the points from which the water begins to flow toward the river. All the points taken together in a river basin from which water begins to flow through the soil toward a river is called the *water-parting*. What is a water-parting? How wide is a water-parting? A water-parting is a line and has no width. Has any line width? How many water-partings has a river basin? Lead pupils to see that the water-parting of a river basin is *one* line. If they say that there are two water-partings, ask them to show where one of the lines begins and ends. Show this upon the molded river basin. Have pupils show the water-parting upon the board. How is your river basin bounded? How is yours bounded (asking another pupil)? How are all river basins bounded? Does a water parting bound a river basin entirely? What else bounds it? Mouth.

Have pupils bound natural divisions by natural lines. There are (from their positions) three kinds of natural lines: (1) Lines formed by slopes meeting at their upper edges; (2) lines formed by slopes meeting at their lower edges; (3) lines formed by slopes of land meeting surfaces of bodies of water (coast lines). Where will you find the river in your river basin? Why do you find it there? Trace the line over which the river flows. Why must the river flow over that line? Could it flow over any other line? What do you find between the river and the water-parting on this side (pointing to slope on the right side of river, *i. e., right* looking down the river)? What do you find on the left side between the river and the water-parting? How many slopes has a river basin? A right slope and a left slope. What forms the line over which the river flows? The meeting of the right and left slope at their lower edges. Bound the right slope. The left slope. What do you call the land over which a river flows? Why does a river flow over its bed? Because the bed slopes. When does the river bed begin to slope? How far does it slope? This slope or inclination of the river bed we will call the *source slope.* How long is the source slope? Does the source slope begin at the source of the river or at the water-parting? How long is the source slope? Two slopes (right and left slope) make up the *entire* river basin; to which slope does the source slope belong?

Does it belong to either or both? How many river basins are there in a river basin? Mold the basin of a river which has several tributaries? The teacher should mold a river basin upon the large molding board. Have pupils draw maps of river basins from the molded forms; put in water-parting, river, tributaries and the body of water into which the main river flows.

Different kinds of river basins. To be molded by pupils:

1. Mold a river basin in which the right slope is longer than the left slope.

2. The left slope is longer than the right.

3. The upper part of left slope consists of a chain or system of mountains and the lower parts plains.

4. The upper part of right slope consists of a chain or system of mountains and the lower parts plains.

5. The upper parts of both slopes consist of chains of mountains and the lower parts of a plain.

6. The upper part of the source slope is mountainous with no other mountains on the upper parts of right and left slopes.

7. A river basin in which there are no mountains.

8. A river basin in which the river flows its entire length in one general direction.

9. A river basin in which the river flows for long distance in two general directions.

10. A river basin which is wholly inside of a system of mountains.

11. A river basin in which there is land higher than the highest part of the water-parting.

12. Mold a system of river basins; *i. e.*, river basins that form one slope, which is drained into one body of water.

A valley is the lower part of the depression which forms the river basin. *Draw each form which is molded.*

Number. In all molding and drawing lead the pupils to *imagine* the length and width of river basins; the width of slopes; the length and width of the river; the heights of water-partings, etc. This practice will lead them to imagine lengths, areas and heights of land that form continents.

Rivers. Upon what does the size of a river depend? How can there be a very large river basin and a comparatively small river? What is the effect upon the size of a river if the soil of the basin is very sandy? If it is a clayey or hard soil? What effect upon the river has a woody basin or a basin covered with forests? What effect upon a river has the removal of forests? How do roots affect the soil? What effect have roots upon the percolation of water? In Nevada the slopes of the Sierra Nevada mountains were once covered with magnificent pine trees. Gold and silver in great

quantities were discovered at a place now called Virginia City. In order to sink the shafts and open the drifts vast numbers of pines were used to support or prop these openings in the mountain sides. The result is that the flanks of the mountains were robbed of their pine forests. The water that falls from the clouds, condensed by the cold tops of the mountains, instead of sinking into the soil and being held by the strong roots of the trees, nourishing them, and then slowly working its way to the valleys below to feed the brooks, lakes or rivers, now dashes down without restraint upon the yielding soil, tears it from its place, ploughs deep furrows in the unprotected sides of the mountain and hurries sand and gravel boulders down to the valleys below. During one storm great fields were covered deep with sand and stone, brought from the mountain sides by the rushing waters, and where once were fertile lands are now only barren sand wastes. Did you ever see any cuts in the ground made by water? Where? Why are trees often planted on the banks of rivers? Why do you often find the grass and bushes very wet with dew? How is moisture affected by foliage? Why shouldn't a large number of trees be planted close to dwellings? Why does water flow in a river? What moves it? What would be the result if there was no source slope? What slope determines the length of a river? What determines the

rapidity with which the river flows? How does it flow over an abrupt slope? Over a gradual slope? Illustrate *gravitation.* Suppose a river had the same grade of slope all the way from its source to its mouth, where would the water flow the fastest? Where the slowest? Why? What is the bed of a river? What line is always in the bed of a river? The line formed by the two slopes, which make the river basin, meeting at their lower edges. This is constantly changing by the action of running water. What does a stream do when it comes to a slope or obstruction which is opposed to the general source slope? Illustrate by drawing and molding. When will the water flow over the opposing slope? *Where* will the water flow over the obstruction? What body of water will be formed above the opposing slope? What is a lake? How are lakes formed in the courses of rivers? Tell pupils about the lakes in the St. Lawrence basin. Where are lakes formed in the course of rivers? Many, many years ago when rivers first began to run, most of the rivers were strings of lakes, formed in the valleys or lower parts of the river basins. Some rivers like the St. Lawrence are like that now. Gradually, in very many years, these strings of lakes changed to one continuous river. Many cities are now resting upon what used to be the bottoms of dried up lakes (like Dayton, Ohio), and many fertile fields with rich crops of grain were once under the deep waters of large lakes.

There are two ways by which a lake in the course of a river may change into a river and leave its bottom dry land. I could tell you about these ways, but I am sure you would like very much to discover them for yourselves. Here is a molded river basin, and here in this part of the course you see, what? An obstruction, a slope opposed to the general inclination of the source slope. What will the water of the river do here? When will it flow over the obstruction? *Where* will it flow over the obstruction? What does a river do to the soil and rock everywhere it flows? Now tell me one way by which the lake might be drained? The river cuts its own way when it does not find a way already cut for it. How long would it take to cut through this obstruction, do you think? Sometimes the obstruction is rock, sometimes clay, or other hard soil. Can a river cut through rock? Tell pupils of the Colorado. What does a river leave on either side where it cuts a channel through an obstruction? A river makes its own banks. How far down into the earth would the water have to cut in order to change a lake into a river?

What colors the waters of a river? The Missouri river, where it pours its waters into the Mississippi, is of a rich coffee color. The water of the Mississippi below the mouth of the Missouri is black. Where does the earth come from that colors the water of rivers? Where does the earth go that a river cuts out between

its banks? Tell me the different ways by which soil is carried into a river. The soil-earth or ground-up rock in a river is called *silt*. Some rivers carry a great deal of it, and other rivers very little. When a river carries very little silt its waters are clear. Take a glass of water in which there is silt (how can you tell whether there is silt in the water?) and let it stand a while. What do you notice? Where does a river carry its silt? When does the silt settle down on the river bed? Why is not the silt deposited in rapid water? Why does silt settle to the bottom in still or slowly moving water? Silt deposited by any body of water is called *sediment*. Sediment, when deposited upon level beds, is usually arranged in layers—*stratified*—why? Notice the action of water after a rain storm. How is the sand, carried by water, spread out? Now, we will come back to the obstructions (opposing slopes) a river finds in its course. What is one way that a river, spread out in the form of a lake, changes back to a narrow river again? Can you think of another?

Suppose a rapid river, filled with silt, meets an opposing slope; what would become of most of the silt? Why would the silt settle to the bottom of the lake? If the river could not cut through the obstruction, how would the bottom of the lake be changed to dry land in such a river? What is a freshet or flood? How are freshets caused? Where do they generally occur?

How do they change a river? Why does the water spread out over the land? In what parts of the river does it keep between its original banks? Why does the river widen above the banks? Owing to the great quantity of water the river, between high banks, becomes choked, and as the flood cannot get through in the usual way, it spreads out. What damage does a freshet do? What good does it do? It makes land richer; how? Sometimes it makes land poorer; why?

The story of the Nile. I will tell you a story of a great nation which could never have existed had it not been for the sediment deposited every year by a great river. This (mold) land you have often heard and read of; it is the land of Egypt. The great nation was that of the ancient Egyptians. Here is a map of the continent of Africa (drawing it on the board), and here is the great river that rises under the hot sun of the equator in these two great lakes, the Victoria Nyanza and the Albert Nyanza. For whom were these lakes named? It took a very, very long time to find where the great river really does rise. The river flows from the lakes toward the north for more than three thousand miles to the Mediterranean sea. Here (pointing) are the mountains of Abyssinia; they are very high and very rugged. From these mountains come down two great rivers, the *Blue Nile* and the *Atbara*, which joins the Nile in its northward course. For twelve hun-

dred miles this wonderful river flows through a great, rainless desert of rolling, shifting sand, the Desert of Sahara. For 1,200 miles the Nile does not receive one drop of water from the clouds or from its basin; indeed, it has no basin all that long distance. The river is much smaller at its mouth than it is 1,200 miles from the place where it pours its waters into the great inland sea. How does the Nile lose its water? Now comes the wonderful part of the story. On the mountains of Abyssinia (here) it rains very, very hard once a year; torrents of rain plough and furrow the ground, make deep cuts in it, and carry enormous spoils of earth down into the brooks; the brooks carry it to other tributaries, and the Blue Nile and Atbara carry the immense quantity of silt brought to them to the Nile, and the Nile in turn takes it over *cataracts* (what are cataracts?) to the desert. The swollen river spreads out its floods over the land, and the land becomes *nearly the richest in the world.* Great crops of wheat and cotton grow upon it. Thousands of years ago a people settled there and became a mighty nation. The *Pharaohs* (kings) built the famous pyramids close by the sands of the desert (here). The people of Egypt almost worship the great river, which they call Father Nile. They watch eagerly for the coming of the yearly flood, and when they see the water rising they shout and sing for joy. The higher it rises the happier they be-

come. So you see floods are sometimes great blessings.

Delta, sand-bars and building land. Some of the silt is spread out by floods over the plains near the river banks, and some is taken by the current clear down to the river's mouth, where it settles and forms land; the land formed by sediment at the mouth of a river is called a delta. Tell them of the deltas of the Mississippi, Ganges and Po. Much of the silt is carried out into the bottom of the ocean, where it is spread out in layers, and after a long time is hardened into stone. Some of the silt in the ocean is swept by waves and tides upon the coasts, where it forms sand-bars and beaches. Tell about the Tide Water Region in the Southern Atlantic States. Show specimens of stratified rock, and call attention to the way the layers were formed. Also stratified rock with fossils, showing how the shells are mixed up with the strata.

Windings of a river. If the meeting of the right and left slopes formed a perfectly straight line, what effect would that have upon the river? There is no such thing in nature. Why couldn't such a river be crossed in boats? Why would the current of such be exceedingly rapid? What effect do the windings or bendings of a river have upon the rapidity of the current? How is a current of a river retarded by *friction?* What is friction? Illustrate. The current of a river

is seldom in the center of the stream; it moves generally on one side or the other, crossing over at a bend. Why does it cross below a bend? What effect has a current, flowing on one side of a river, upon the land near it? (Upon the banks?) Of what other uses are the windings of a river except to retard the rapidity of its flow? Navigation; irrigation. A river that winds very much is sometimes called a *meandering* river. This name comes from the river Meander in Asia Minor. The *Jordan* river flows 200 miles from the sea of Galilee in order to reach the *Dead Sea*, a little more than sixty miles. Draw maps of winding rivers. Some rivers change abruptly the general direction of their courses—Columbia.

Changing the line. The line formed by the meeting of the right and left slopes of a river basin is constantly changing. Where is this line always to be found? The river always flows over this line and generally the current flows over it. We have found that a river *cuts its own way* through whatever obstructions (opposing slopes) it may meet; it not only cuts its way through the obstructions, but fills up the lakes or widened river bottoms with sediment. A river cuts its bed down *vertically* in forming its banks. Illustrate on molding board. A river very often changes its bed. How? What line is changed when the river bed is changed?

The current of a river changes very often; steam boat pilots are obliged to watch for these changes with the greatest care; why? A river current is generally eating into the bank nearest it; it cuts away the earth or rock and carries it down the stream. Thus, you see, it not only cuts away the earth in its bed (*vertically*), but also cuts away its bank, generally on one side at a time; which side? The river wears away (*abrades*) earth in two directions; one vertically and the other from side to side, *horizontally*. Illustrate how the bottom lands of the Illinois river and the Mississippi are formed by the horizontal movement. Some rivers make most of their basins by erosion

The source slope. Review questions. What slope determines the length of a river? What determines the rapidity of the current? Where will the current be swift? Where very slow? How are rapids, cataracts and falls made? What is the difference in the slope of a river bed between rapids and falls? Illustrate with molding and drawing. Show pictures of and tell pupils about Niagara Falls. Describe how the rock is slowly wearing away; show pictures of the steep banks below the falls, and ask how they were made. What will be the result when the falls cut their way back to Lake Erie? Tell pupils about the falls in the Zambesi, the cataracts of the Nile, and the *Dalles* of the Columbia.

Rivers which rise in highlands rush down the com-

paratively abrupt slopes, and flow slower over what may be called the middle course, and still more slowly over the lowest part of the course. Thus most rivers have three distinct divisions in the source slope: (1) an upper course, where the current is rapid; (2) a middle course in which the current is slower than it is in the upper course; (3) a lower course, in which the river creeps over a very slight grade of surface inclination. Some rivers are very rapid in their flow from the source to the mouth, while others, following gentle inclinations throughout their courses, are, therefore, sluggish all the way.

Uses of rivers. Tell me all the uses of rivers that you can think of. Have pupils discover such uses. Manufacturing; navigation; furnishing canals used for transportation with water; moving logs; cutting the earth in their basins so that railroads can be easily built; irrigation, natural and artificial; water supplies for cities; preparing land for cultivation; making harbors or sea coasts; furnishing land and gravel for building purposes; furnishing food (fish); cleansing the land by carrying off impurities; supplying ice.

Manufacturing. What kind of rivers are used for manufacturing? Which course of a river (upper, middle, lower,) is generally best adapted to manufacturing purposes? On what parts of a river are mills, factories and other manufactories built? Name articles that

are manufactured by machinery driven by water and steam. Why are mills and factories built near falls or rapids? What is a dam? How is it built? For what is it used? How is the canal built which drives the big wheel? Describe the factories at Lowell, Manchester and Lawrence.

Navigation and commerce. What kind of rivers are used for navigation? In navigable rivers which course (upper, middle, lower,) is generally best adapted to navigation? What in a river usually stops navigation? Canals are sometimes used to take steamboats around falls. Describe the commerce on the Mississippi river and its tributaries. Thirty years ago there were many more steamboats and flatboats in use upon the Mississippi than now. There are greater quantities of goods transported now than there were then. How do you account for this change? Tell pupils how loose logs and log-rafts are carried down rivers—Mississippi, Merrimack, Penobscot.

Railroads. How does the wearing of land (erosion) assist in building railroads? Union Pacific Railroad.

Canals. What is a canal? What is the difference between a canal and a river? How are canals made? What supplies canals with water? What are canal locks? What is the use of locks? What are the uses of canals? Manufacturing, transportation. How are

boats moved on canals? Before railroads were built people traveled upon canal boats called packet boats. Describe the Erie canal, Suez canal, the proposed Hennepin canal, Panama canal.

Irrigation. What is irrigation? How does the water in rivers irrigate the soil? Some rivers receive their water from the upper or mountainous parts of the slopes or river basins. Why? Why, in some slopes or river basins, does rain fall only upon the upper edges or mountainous parts? What is the effect of such conditions upon the lower parts of the river basins or the valley of the river? Mold a river basin and illustrate the conditions above given. Lead pupils to discover a plan by which the dry soil of the river valley may receive moisture enough for vegetation. How could the main ditch or canal be made? The smaller ditches? How do land slopes assist in irrigation?

A few years ago the basin of the Platte river in Colorado, just east of the Rocky Mountains, was a desert covered with *alkali;* the land was worthless. There is plenty of water in the river and plenty of water in the mountains, for their snowy tops wring the moisture out of the clouds forced over them by the winds. But the cold tops of the mountains left little or no rain for the plains below, so some thoughtful and enterprising men built canals or ditches in which to carry water from the upper course of the river,

like this (illustrate). From this main ditch run little ditches which are filled with water to irrigate the farms (ranches they are called in the West). By *artificial* irrigation the desert is made to "blossom as the rose." Wheat, oats, barley, potatoes and vegetables are now raised there in great abundance. Some farmers say that they prefer irrigation to rain. Why? For irrigating purposes water is sometimes raised from rivers by pumps. Show pictures; Nile. Windmills are often used to fill irrigating ditches. Many years ago great plains in Asia west of Hindoo Koosh and other great plains in Africa west of the mountains of Abyssinia were made fertile by irrigation. Now these plains are deserts. Why?

Harbors. The shores of the ocean in some places are building coasts. The currents of the ocean and the waters of the rivers bring and pile up sand (form sand-bars), and in time plants and trees grow upon these sand-bars and change them into islands. What effect do these sand-bars have upon navigation and commerce? On *wearing coasts*, where the waves and tides are ever eating into the rocks, there are generally good harbors; why? What constitutes a good harbor? Where do you find good harbors on building or sandy coasts? Why do you find them at the mouths of large rivers? James, Cape Fear, Savannah.

Coasts and coast lines. Mold land sloping down to the ocean. Where is the coast? What is a coast? What is the coast line? How wide is the coast line? Mold a coast with hills and mountains close to the ocean. Describe the tides. Tell pupils about the waves that beat against the coast. What is the effect of the tides and waves upon this (rocky) coast? Where does the ocean cut into the land? Make a change in the molded coast so as to form a bay? What is a bay? Mold the gulf and peninsula of California. Show how the waters of the Pacific fill up the valley between the mountain ranges. What is a gulf? What is the difference between a bay and a gulf? Mold bays, gulfs, seas, harbors, inlets, fiords, estuaries, bights; have pupils describe, draw and mold the same. Have pupils discover how these indentations were formed, and tell their uses. Mold wearing coast; illustrate how such a coast is made. Describe the formation of sand-bars washed up by waves and tides, and how marshes are formed between the sand-bars and the mainland; how both become part of the mainland and then how new sand-bars are formed. Tell them about the Tide Water Region on the Atlantic coast of North America. Draw, mold and compare that portion of the Atlantic coast north of the mouth of the Hudson with that portion south of it.

Mold and draw a peninsula after field lessons.

This is a *peninsula;* what is a peninsula? Why was not this land washed away by the water with the land around it? Change this peninsula into an *island.* What is an island? What is the difference between a peninsula and an island. Why are peninsulas and islands nearly always rocky, hilly or mountainous? Some islands look as if they had been broken off from mountain ranges—Great Britain from the Scandinavian mountains, Sicily from the Appennines.

Mold and draw a promontory. What is the difference between a promontory and a peninsula? Mold and draw a coast with a peninsula, a promontory, an island and a cape. What is this? (pointing to a cape.) What is a cape? What is the difference between a cape and a peninsula? How many capes can you see on this coast? Have pupils mold coasts with all the indentations and projections; a peninsula, promontory, island, cape, delta, bay, gulf, sea, inlet, estuary, fiord. Tell pupils about (draw, mold and show pictures of) fiords of Norway; the ice bound coast of the Arctic ocean; how glaciers enter the ocean and are broken off by the waves and sail away as icebergs; the islands of the Southern Pacific coast of South America. A lesson upon islands should be given. Describe continental islands and oceanic islands; volcanic islands, coral formations, atolls, reefs, Floridas.

NOTE.—The plans and hints above given are in-

tended to suggest lines of work. Many of the questions are, no doubt, far too difficult for pupils of the fourth grade. The skillful teacher will readily discriminate between questions which are and those which are not adapted to her pupils' mental powers. The questions that are too difficult for present use will suggest the necessity of cultivating the power to answer them in the next or higher grades.

Reading. "Seven Little Sisters," "Each and All," "Aunt Martha's Corner Cupboard," Scribner's "Geographical Reader," "Little People of Asia," Dodge's "Stories of American History," together with stories of travels over mountains, plains and sea coasts.

Language. Writing should continually be used in giving the substance of lessons. Have pupils describe something in writing each day.

Number. Many problems should be made with the purpose of gaining clear ideas of distance, areas, heights and relative proportions. This slope from the sea coast (pointing to molded slope) is fifty feet above the sea level at the foot of the hill: the hill is 250 feet above the sea level; what is the height of the entire slope? How much higher above the sea is the top of hill than the slope at the base of the hill? If the sea should wash away the slope up to the foot of the hill, how high would the hill be then? It is five miles in a straight line from the coast line to the base of the hill;

what is the average inclination of the slope to the mile? What is the average grade of inclination to the mile from the sea to the summit of the hill? Here is a river basin (molded); it is 100 miles, in a straight line, from the source to the mouth; the river is 175 miles long; how many miles does the river wind? The right slope, in the longest part, is twenty-five miles from the water-parting to the river; the left slope, opposite the longest part of the right slope, is thirty-seven miles long; how much longer is the left slope than the right slope? How far is it on this line, from water-parting across the basin, to water-parting? The source is 500 feet above the mouth; the river is 175 miles long; what is the average grade of slope to the mile? If the river flows two miles in an hour, how long would it take a drop of water to go from the source to the mouth? The highest part of the water-parting on the left slope is 250 feet high; the highest part of the source slope is 500 feet high; the highest part of the right slope is 150 feet high; how much higher is the right slope than the left slope? The right slope than the source slope? Each problem should lead pupils to imagine height, distance, area or proportion.

The weather. Keep a daily account of the weather upon the blackboard. 1. Direction of the wind. 2. Force of the wind. 3. Degree of heat; pressure of atmosphere in barometer. 4. Rain or snow. 5. Sun-

shine. Have pupils read weather reports and notice whether the predictions prove true.

FIFTH GRADE.

Review thoroughly all the work of the previous grades. The more carefully the elementary work is done the better and quicker the science of geography can be taught. All the concepts of natural features are to be brought together, combined, mingled and blended into one great whole; that is, a concept is to be formed in the pupils' minds which corresponds generally to the real continent of North America. The teaching of the first continent should be very carefully done, as the other continents, one by one, will be compared with it; it will, indeed, be the principal means of teaching all the other continents. There is no good reason why North America should be preferred to South America in beginning, except the fact that it is our own continent.

Molding in sand, drawing, and descriptions both oral and printed, are the means by which the concept is formed. By molding the fundamental concept of the upraised mass is made clear. Still the warning given must be repeated—molding, although an excellent *means*, may become an *end*, and the pupil's mental vision be limited almost entirely by it. Oral and written descriptions assist very much in avoiding this, the

main difficulty. Lead pupils to see beyond the sand, else the work is useless.

There are several plans of teaching continents by molding. (1.) Draw the outline upon the large molding table and cover the surface within the outline with a thin layer of sand. Upon this layer of sand build the great western mass of land, crowned by the Rocky Mountain system; follow this by the eastern or lesser land mass with the Appalachian system. From this go to river basins and river systems. (2.) Mold the Rocky Mountain system first, then add the slopes, one to the Pacific ocean, the other to the Mississippi and Mackenzie rivers; follow this by molding the Appalachian system and the slopes to the Atlantic and toward the west. (3.) Mold the entire continent before the lesson, and have pupils describe what they see, taking, of course, the most prominent features first.

The fourth way is to begin with the simplest general whole, to-wit: the two slopes which form the entire continent, the long slope and the short slope. Present these unmodified by counter slopes and river basins. Mold a rough outline (coast line) around the two slopes, giving a brief description as you mold. Then mold and describe the most prominent modification of the long and short slopes. The line of procedure in this plan and, indeed, it should be in all devices, is from the most prominent, natural divisions (those embracing the

largest areas) to the next in importance and size. *Mold in the general whole each natural division as you teach it.* Some teachers, lacking in technical skill to mold, may shrink from the work. Of course the more thorough the preparation you make, other things being equal, the more economically you can use time in teaching. Yet, if you haven't the skill, *have the courage to begin;* "the way to resume is to resume." If you haven't a good relief map from which to copy, you can interpret in sand good physical maps like Guyot's and Stanford's, or you can use pictures of relief found in Swinton's Geographies and others.

The fourth plan is illustrated below. Only a meager description is given and very few questions are asked compared with the number a skillful teacher will easily think of. Avoid too many details; teach those facts only in these first steps, which assist in making clear the general whole. Keep steadily before you the purpose of building in the mind the continent as a whole with its content of general features. When a clear general picture has been acquired, details without number may be filled in.

NORTH AMERICA.

A pile of dampened sand lies upon the molding table. Be careful not to have the sand too damp; just enough water should be mixed with it to make it work

easily. Mold the two slopes of North America. I want you to think of a great mass of rock raised above the ocean level. Here (pointing) is the Pacific ocean; here the Atlantic, and here the Arctic ocean. This mass of upraised rock is 5,700 miles long. How long would it take you to travel on foot the entire length of this continent, if you traveled twenty miles a day? How long would it take you to ride over it on a railroad train, if you rode thirty miles an hour?

This continent is 3,000 miles wide—from East to West—in the widest place; how long would it take to go on the cars from New York to San Francisco at the rate of thirty miles an hour? The area of the continent in square miles is 9,349,585. How many farms of 640 acres could the whole continent be divided into? Would all the land make good farms? Why not? If 20 people lived on a square mile, how many inhabitants would North America have? Write all these figures upon the board. Make other problems. How many slopes do you see? What is the difference between the slopes? This slope (the long one) is 2,200 miles long; how long is this slope? (the short one.) Compare the two slopes. Into what ocean would the water on the long slope flow? On the short slope? Point out the line of meeting of the two slopes. How long is this line? This line is called the *continental axis;* What is a line? How is a line formed? How wide is

the continental axis? The teacher molds the outline of the continent, describing each part. Here is the outline of what? Peninsula of Alaska. Just across this strait is Asia, another continent. This is the coast line of what ocean? Pacific. Here are several islands which look as if they had been broken off, some day, from the continent. What would break them off? *Queen Charlotte's* island, *Vancouver's* island. The water which separates Vancouver's island from the main land is called *Puget's* Sound. What is a sound? How does it differ from a gulf? Here is a very long bend or curve in the coast. These mountains (coast mountains) cause the coast line to curve. Mold the peninsula of California. Here is a long low range of mountains; between this range and the next range is a depression lower than the ocean level; the lower end of this depression opens upon the ocean; what ocean? What would we find in this depression? How far does the ocean flow into this depression? What does the water form? Gulf of *California.* Which way does the coast line curve now? Toward the east. Now the coast line curves out from the main land, and now it curves into the main land, and then out again. What have I molded? In what general direction does the coast line run? What determines where the coast line must be?

Now I will begin at Bering strait and mold the

northern coast line of the continent. The coast line of what ocean? Arctic ocean. The outline of this coast, in all its parts, is very imperfectly known. Why? Very cold climate. Never has been surveyed. Why has it not been surveyed? When can ships come here? Why not in winter? The water is frozen most of the year. Great masses of land have been broken off from the main land, forming what? This (molding) is Bank's land; this Prince Albert, and here is *Baffinland*. Tell pupils of Sir John Franklin, Dr. Kane, Lieut. Greeley. Here is a great depression in the continent filled with water—*Hudson's Bay*. Now the coast line moves south-east, broken by this point, Cape Chudleigh. What does this land form? A peninsula. What water is on the eastern side? What on the northern side? Here the coast line turns toward the south and here begins the Atlantic ocean. A narrow strait separates the main-land from a large island—New Foundland. Why do you think it is called by this name? What is this? Gulf of St. Lawrence. What are these? Two islands—Prince Edward and Cape Breton islands. Mold Nova Scotia. What is this? The water, which here separates the peninsula of Nova Scotia from the main land, is called the Bay of Fundy. The tide rises in this bay to a great height. Now the coast line curves in, and here is a curious form like a fish-hook—Cape Cod. Right across this little bay the Pilgrims landed in ——?

There is a sharp turn around Cape Cod, and the coast line runs toward the west. This is *Long Island* Sound; and this island is Long Island. Now the line moves toward the south; the water of the Atlantic enters the land in two places, you see—*Delaware* Bay and *Chesapeake* Bay. Then follows a curve. Long sand-bar islands are found here. Can you tell me anything about them? This peninsula was made by little bits of animals which lived and died and left their bones to build islands and peninsulas like this—*Florida*. Now we are in the Gulf of *Mexico,* a great, deep, broad depression, filled with water. Here at the entrance is a long, narrow island—*Cuba*. East of it is another island—*Hayti,* and east of that a little island—*Porto Rico*. North of these large islands (*West Indies*) are a great number of small islands—*Bahama* Islands. South of the West Indies is the *Carribean Sea*. This sea is a part of a great ocean current that comes across the Atlantic from the hot shores of Africa. It pours an immense flood of warm water between the West Indies and the northern shores of South America and the shores of this *isthmus*. (Mold all forms mentioned.) What is an isthmus? Then a part of it moves on between Cuba and *Yucatan,* through the Yucatan *channel* in the Gulf of Mexico. What is a channel? How does a channel differ from a strait? In this gulf the Gulf Stream turns around (why?) and flows between

Cuba and Florida, up the coast; then it crosses the Atlantic to warm the shores of *Great Britain* and Scandinavia. Illustrate by drawing. Now we have traveled on the coast line around North America. Bound this continent. Write a description of the coast line I have molded.

Take your pans and mold North America with its two great slopes. Trace the continental axis. Bound the long slope; the short slope. Bound by *natural lines.* How long is the long slope (from east to west)? How broad is it (from north to south)? Where is it the shortest? Where the longest? The long slope is inclined toward what ocean? It does not slope all the way like this. Mold in the long slope, the Appalachian mountain system and the southern and western water-parting of the Hudson Bay system. Mold the slopes of this land mass. Where will the water on the long slope flow now? Mold the Mississippi river basin, *i. e.*, change the general form of the slope. Where will the water flow in this basin? Why? Trace the main river—Mississippi. Why does the river flow over that line? How much land does this river drain? Mold the *Mackenzie* basin. Which way does the water flow here? Into what ocean? Why? Trace the river. Mold the *Saskatchewan* basin. What change do the basins of the Mississippi, Mackenzie and Saskatchewan rivers make in the long slope? Lead pupils to see the great central

valley of North America. Trace on molded map the Mississippi river from its mouth to its source. What causes this river. Two slopes meeting at their lower edges. Show me the slopes. Trace the Mackenzie river in the same way. Show me the slopes this river drains. What separates the Mississippi basin from the Mackenzie basin? Saskatchewan basin. Trace in molded map the lowest line (above the sea level) from the mouth of the Mississippi to the mouth of the Mackenzie. Into what does this line divide North America? Which is the larger mass of land? Which is the smaller? In which is the continental axis? The larger mass we will call the primary land mass; the smaller the secondary land mass. By what is the primary land mass divided? Into what does the continental axis divide the primary land mass? Bound the western slope. The eastern slope. Which is the longer? (eastern or western.) Where do most of the rivers rise in the western slope? The eastern slope?

Secondary land mass. How many slopes has the secondary land mass? Where do most of the rivers rise in the western slope? In the eastern slope? Trace the line that divides the two slopes. This line is called the secondary axis of North America. Mold the St. Lawrence basin. What effect does this basin have upon the secondary land mass? The river separates it into two parts. Which part is the larger? Mold the Appa-

lachian mountain system. These mountains begin where?—(St. Lawrence basin) and extend in what direction?—nearly to what? Gulf of Mexico.

I must tell you something about mountains and mountain systems. Mountain systems are the upper or highest parts of great land masses. They look very large because they rise so abruptly from the general level of the land, but they form really a very small part of a great land mass. If all the mountains were ground up to fine powder and spread over the rest of the land they would form a very thin coating. You must think that a mountain system is the *upper part* of the land mass. A mountain system consists (is made up) of several ranges or chains, which extend in the same general direction. These ranges are sometimes called parallel, but they are not really parallel. Illustrate by molding. A mountain range, like a coast line, curves and bends so as to form a very crooked line. From the Susquehanna river (mold) down nearly to the Gulf of Mexico the Appalachian mountain system consists of the so-called parallel ranges. Here is the *Blue Ridge*, one of the ranges. It is called a *ridge*, I suppose, because, for a long distance, this range is really a ridge; that is, it has one continuous crest like this (mold). Over the Blue Ridge runs the secondary axis; several rivers break through it. West of the Blue Ridge, and nearly parallel with it, is the *Allegheny*

range. Between the Blue Ridge and the Allegheny range is a long valley. It is not a continuous valley, however, for several small ranges run, laterally, in the same general direction as the Blue Ridge and the Alleghenies. These ranges often come together and form knots which obstruct the valleys. The upper end of this long valley is called the Valley of the Shenandoah; it was made famous in the Civil War; the lower end is the Valley of the Tennessee, out of which the river Tennessee rushes. Just where the Tennessee river flows out of this valley is Chattanooga. What do you know of Chattanooga?

North of the Susquehanna river the mountain ranges are not so regular. Here are the Catskills, and south of them the Palisades on the Hudson. North of the Catskills is a comparatively level country, although there is a gradual slope to the Atlantic. Just north of the level land are the Adirondacks, so famous for fishing and hunting. Then comes a long, deep depression or break through the mountain system, which extends from the St. Lawrence basin to the ocean. The northern part of this depression is partially filled by Lake Champlain. Down through the southern part flows the beautiful Hudson. The eastern side of this long valley has the Green and Housatonic mountains for walls. The Green mountain range extends (under other names) to the St. Lawrence basin and there forms the upper part of the

right slope of that basin. East of the Green mountains, across the Connecticut river, is a bunch or knot of mountains called the White Mountains. Thus we have had a glance at the Appalachian system. Tell me all you can about it. Write a description of it.

The St. Lawrence River, I have said, separates what? The northern part of the secondary land mass is north of the St. Lawrence River, and is called the Peninsula of Labrador. A mountain range runs through it from south to north. The eastern slope pours its waters into the Atlantic, the western into Hudson's bay.

From these small mountains, which are called wrinkles or folds of the earth's crust, we will turn to the mountains which form the upper part or crest of the great primary land mass of the West. We have traced the continental axis the entire length of the continent; now I will begin at the narrowest part of this immense mass of rock and try to show you, by molding, how these mountains look. Here in this isthmus of Panama, only fifty miles from ocean to ocean, there is one low range of mountains, at the lowest point only 150 feet high. Who is trying to dig a canal here? How would this canal help commerce? There is only one range until we reach this high mountain—Popocatapetl—17,784 feet high. From this point there are two immense mountain ranges, which extend to the frozen ocean, more than 5,000 miles. (Roughly out-

line the two ranges in the sand.) Between these two ranges is a vast *plateau.* What is a plateau? Here in *Mexico* the plateau is wedge-shaped with very high mountain walls on the west; but on the eastern edge of the plateau there are few mountains. If you were on the coast of the Gulf of Mexico (pointing) you would see, to the west, what would seem to be a high mountain ridge. If you were to climb up the steep slope you would find on the top a comparatively level plateau. In the northern part of this plateau of Mexico, and on the eastern edge, the great range of the Rocky mountains begins to rise. It runs nearly due north for more than 500 miles. Here the Rio Grande breaks through the range, then the range curves to the west. This curve is about 450 miles long. Not far from the western slope of this long curve flows the Rio Grande, and at the foot of the eastern slope of the range flows the *Rio Pecos,* which unites with the Rio Grande near where the latter river breaks through the mountains. Now this great Rocky mountain range, instead of continuing as a single range, breaks up into all sorts of wonderful forms; it turns, bends, twists and knots up in such a way that it is very difficult to mold or describe it. These curious mountain knots extend in a northerly direction for more than 500 miles. I can describe it best by molding and telling you about the wonderful Rocky mountain parks. These parks are

in this range. (Mold San Luis valley by itself.) Imagine a valley, as level as a table, nearly 8,000 feet above the ocean level, 140 miles long and from thirty-five to forty miles wide, walled in by snow-capped mountains. It is drained by the upper course of the Rio Grande. Northeast from the San Luis valley, just over a high mountain range, is the South Park—fifty miles long, twenty-five miles broad and in shape like an *ellipse*. This magnificent park is in one place 10,000 feet above the ocean level. North of South Park is Middle Park, and north of that is North Park. Farther north are the plains of Laramie, drained by the North Platte river, which breaks through the Rocky mountains. North of this break the range bends toward the west, in which direction it runs for nearly 300 miles; then it bends to the north again. About 100 miles from this curve of the range is the wonderful Yellowstone Park. Can you tell me anything about this park?

Show pictures. Teachers should collect a large number of pictures of mountain scenery.

From the curve in which we find the Yellowstone Park the Rocky mountains move steadily in a northerly direction to the Arctic ocean. Very little is known of them after they enter the frozen regions of the North; there may be more wonderful parks and some high peaks that are yet to be discovered.

Now we will begin again at the narrow isthmus

and see how the great western wall of the plateau looks. This range, which runs in the same direction as the Rocky mountains, has several names. We will call it by the best known name of *Sierra Nevada*. *Sierra* means saw, and *Nevada* a heavy fall of snow. Why do these mountains have this name? Rising from the low mountains of the isthmus of Panama the range reaches a very great height, just opposite (west of) the southern coast of the Gulf of Mexico. Here we find Popocatapetl and a knot of very high mountains. This is a volcanic region. What is a volcano? In these mountains, eighty miles from the Pacific ocean (point), happened something very wonderful in 1759. How many years ago? From comparatively level land, 2,800 feet above the ocean, sprang up all at once a volcano (Jorullo), 4,205 feet above the ocean; how high above the plain? This range is called the Sierra Madre here; it curves to the west and then to the north. From *Cape Corrientes* (here) this range extends in a northerly direction (a little west of north) for 500 miles to where the Colorado river breaks through it in its mighty struggle to enter the Gulf of California. Here the range separates into two ranges. One is the Wasatch range, which extends to the northeast *diagonally* across the great plateau, and joins the Rocky mountain range, where it turns toward the north, sending out straight toward the east a *spur* called the Uintah mountains. At

the Colorado river the western wall sinks into a great desert or plateau called the *Mohave Desert,* in which is the famous *Death Valley,* 100 feet below the level of the Pacific. Why does not the ocean cover this valley? Across the parched and barren Mohave Desert, in the northeast, this range rises again into towering, snow-capped mountains (the true Sierra Nevada range). Inclined toward the east this range extends in a northerly direction for 450 miles. It is the buttress of the great plateau and the eastern wall of the Valley of California. The waters which drain its steep slopes cut out from the hard rock bits and nuggets of gold. The upper course breaks through the range just south of Mt. Shasta (show pictures), and the range turns slightly toward the east; 280 miles more and the Columbia river dashes through the lofty mountain walls. The range north of and including Mt. Shasta is called the Cascade range. Why? Here we find *glaciers* on Mt. Tacoma 14,444 feet high, just two feet higher than Mt. Shasta, on which there is also a glacier. Now we find a long curve from the ocean (nearly 500 miles). At the foot of the abrupt slope of the range (here) lies Puget's Sound; across this sound is Vancouver's Island. Here the mountains continue in their northerly direction to Mt. Fairweather (15,500 feet), and Mt. St. Elias (19,500 feet), the highest peak in North America. At these lofty peaks the range bends almost directly to-

ward the west and extends hundreds of miles out into the waters of the Pacific ocean (Alaska peninsula).

Coast range. For a very long distance the Cascade and Sierra Nevada mountains do not descend directly to the ocean. This range, or these ranges, have foot hills, or they might better be called *foot mountains.* I will mold them, beginning here at Vancouver's Island. The valley between the coast range and the higher range is filled with water (Puget's Sound). This range runs close to the coast toward the south; in fact, it determines the coast line. How? It extends in the same direction as the Sierra Nevada range, although much lower. It makes a great sweeping curve into the Pacific ocean. Here (pointing) the coast range on the west and the Sierra Nevada on the east inclose the basins of the Sacramento and San Joaquin rivers. The Sacramento flows toward the south; the San Joaquin toward the north. The two rivers unite nearly opposite the Golden Gate of the Pacific Ocean. These two basins form the wonderful and magnificent Valley of California. A little southwest of the Golden Gate, 150 miles in the Sierra Nevadas, is the famous Yosemite Valley, the great rival, in wonders, of the Yellowstone Park. (Show pictures.) In the southern boundary of the San Joaquin basin the coast range unites with the Sierra Nevada range, and sends out a long branch or spur to the south, which forms the peninsula of California.

Now, as we have had a glimpse of the huge mountain walls or buttresses of the great plateau, we will look at the plateau itself. The southern part comprises the plateau of Mexico. It is wedge-shaped with high mountain walls on the west side and an abrupt slope to the gulf on the eastern side. This part of the great plateau really extends toward the north for more than 2,000 miles, enclosed on the east by the Rocky mountain range, on the west by the Sierra Nevada and Wawsatch mountains, and shut in on the north by that section of the Rocky mountain range which runs east and west. The northern part of this plateau is the upper basin of the Colorado, and the middle portion is drained for the greater part by the Rio Grande. Now comes the Great Basin, shaped like an ellipse, 600 miles in breadth, 900 miles from north to south, and enclosed by the Sierra Nevada, Wawsatch and Rocky mountains; drained in the north by the Snake river, in the south partially by the Colorado, while a large space in the center has no outlet. The water flows in streams (Humboldt) and loses itself in *sinks*. I thought once that plateaus were level like prairies. This is very far from the truth; indeed, this plateau is a great mass of mountains, range upon range, extending in a general direction from north to south. (Read descriptions.) If you were to travel on any one of the railroads that run over this vast plateau to the Pacific you would not

think that a plateau is level. Mountains, mountains everywhere, on the right and on the left. Great, arid, treeless expanses; no vegetation except sage bushes and prickly pears, growing out of dry soil covered with alkali. Miles and miles of villages inhabited by prairie dogs. The houses in these villages are little mounds of earth, the doors are holes, at the entrances of which the inhabitants (prairie dogs) sit and watch the passing trains. Wherever water can be obtained from the snowy-topped mountains this desert may be made fertile. The Mormons in Utah have changed dreary wastes to rich fields. No doubt there are millions of acres yet to be reclaimed from sage bush, prickly pear and prairie dog by irrigation.

The teacher should mold the continent again and have pupils mold upon pans, following the teacher and describing natural divisions as they mold. Ask the pupils many questions relating to the work done about North America. Put aside maps and ask questions. *Test, continually, your pupils' power to picture the continent without the presence of maps.*

Have pupils draw maps of the continent on the blackboard from the molded form. Lead them to imagine the coast as they draw it; tell whether they are wearing or building coasts, and why. What mountains do you see? Why can you not see the mountains from this part of the coast? Too far off. How far? What

islands? How were they made? What peninsulas? How made? Bays, gulfs, mouths of rivers, etc. Do not be afraid of very crude results at first; lead pupils to criticise their own work, and *try again*. The only use of either drawing or molding is *to picture the continent;* drawing maps is a worthless process unless it makes the concept clearer. Have them begin, for instance, with the peninsula of Alaska, and draw the coast line of the Pacific ocean. Have very little detail at first. How was this peninsula formed? By what mountains? What islands do you see? How do the coast mountains look? Where are the Sierra Nevadas? How far away? Draw first the Arctic coast line. Describe this coast, then follow with the Atlantic coast line, and lastly with that of the Gulf of Mexico. Draw continental axis, secondary axis, and indicate mountain ranges.

Mississippi basin. Before the molded map. Bound the Mississippi basin. *Have pupils discover the boundaries.* The use of bounding natural divisions is to stimulate the power of close observation. *Bound always by natural lines.* The Mississippi basin is bounded upon the west by the continental axis, and the water-parting of the Texan river basin system; on the north by the water-parting of the Saskatchewan or the Winnipeg basin, and the water-parting of the St. Lawrence basin; on the east by the secondary axis and the water-

parting of the Alabama river basin system. Bound the right slope of the Mississippi river basin. What great river basins are there in this slope? Which is the largest? Describe the upper part of this slope; the middle; the lowest part. What mountains are entirely in this slope? Ozark. Bound the left slope. What are the great river basins in this slope? Mold as you ask questions. Describe the upper part of this slope; the lower part. Compare the right slope with the left slope. Which is the larger? The higher? Which contains the larger number of river basins? Compare the basin of the Missouri with the basin of the Ohio? What and where has this river basin the greatest breadth? The least breadth? The greatest length? What and where is the greatest height of water-parting? The least height? Where in this basin is the richest soil? Why is it found here? Describe the prairies; the alluvial soil. Draw on the blackboard the water-parting of this basin. Indicate the different boundaries, continental axis, secondary axis, water-parting of the Winnipeg basin, etc. This basin contains 1,256,-000 square miles of land, most of which is fertile. How many States of the size of Rhode Island (1,250 square miles) could be made out of this basin? How many States as large as New York (49,170 square miles)? How many countries as large as Great Britain and Ireland (121,603 square miles) could be made out

of the Mississippi basin? If a hundred people lived on each square mile, how many inhabitants would this basin have? If this basin were divided up into farms of 640 acres (a section), how many farms would there be? If there were raised on each farm 1,820 bushels of wheat, how many bushels would be raised in the whole basin? Draw (pupils) the water-parting and indicate the mountains; draw the rivers. How high is the source slope? How high above the ocean level must one be in order to step over the Mississippi water-parting into the Winnipeg basin? Write a description of the Mississippi basin. Mold North America (pupils) and put in all the modifications just learned.

Mackenzie basin. Bound. Draw (pupils) water-parting. Bound the left slope. The right slope. Describe the upper part of the left slope. The lower. The upper part of right slope. Compare the right slope with left slope. Draw water-parting and trace the rivers. What lakes are in this basin? What effect has the frozen river upon the lakes? Where, in spring or summer, does the snow melt first? Why? What effect has the freshet upon the river valley? What do you think about the vegetation in this valley? The area of this basin is 442,000 square miles; how much larger is the Mississippi basin? How many times larger? Compare the Mississippi basin with the Mac-

kenzie basin. In what do they resemble each other? In what do they differ?

Hudson's bay basin. Bound. Describe the right slope. Bound the left slope. What river brings the most water to Hudson's bay? Bound the Winnipeg basin (including the Saskatchewan), Red river of the North, Lake Winnipeg and Nelson river basins. How is Lake Winnipeg connected with Lake Superior? What can you say of the vegetation of this basin?

St. Lawrence river basin (embracing the lake basins). Bound the right slope. The left slope. Describe the upper part of the left slope. Of the right slope. Where has the water-parting the greatest altitude? The least? What connection have the waters of this basin with the waters of the Winnipeg basin? How have the lakes been connected with the Mississippi? With the Hudson river? By two canals. How many lakes in this basin? How do you think they were made? How will the lakes, in time, be changed to a continuous river? Describe Niagara Falls. When the falls reach Lake Erie, what will be the result? In what ways are lakes, in river basins, changed to dry land? Can you give any good reason why these lakes have not yet been filled up with sediment? What would be the effect if the waters of the Winnipeg basin flowed into Lake Superior? Describe the St.

Lawrence basin. Compare it with the Mississippi basin; the Mackenzie basin. The area of the St. Lawrence basin is 298,000 square miles. How much smaller than the Mackenzie basin? The Mississippi basin? How many times smaller than the Mississippi basin? In the upper part of the left slope of this basin are the Laurentian hills. Geologists tell us that this range was the first land which appeared above the ocean. One peculiarity of the St. Lawrence basin is that, for a large river, its water-parting is on the average very low. The upper part of the basin, above the outlet of Lake Ontario, is nowhere above 1,600 feet. Most rivers, you know, were once strings of connected lakes, which, by erosion and the filling up by eroded earth, have slowly changed the lakes to rivers and the lake beds to fertile land. But the St. Lawrence basin seems to be one great exception to this change, and the fact may be accounted for by the shortness of the slope and the low altitude of the water-parting. Possibly if the waters of the Winnipeg basin were turned into Lake Superior through the string of lakes which now connect it with Lake Winnipeg, immense quantities of silt from the Rocky mountains would, in time, transform the beds of the great lakes to dry land. The result of such a change is evident; the lakes would be filled, in time, with silt and one mighty river would flow from the Western highlands to the Atlantic ocean; a river

similar to the Amazon. Commercially, the St. Lawrence river, with its lakes, is of great importance to North America. When the proposed Hennepin canal is made, great ships will sail from what point to what point? What would they carry? Mold (pupils) the continent and put in all the modifications as now understood. Draw from the molded forms.

Atlantic system of river basins. We have so far studied all the great river basins of the continent. We will now study the river basin systems. What is a river basin system? Several river basins joined by water-partings, and forming one continuous slope, which is drained into one body of water.

Bound the Atlantic river basin system (south of the St. Lawrence basin). Describe the upper part of the slope; the lower part of the slope. Compare the lower part of the slope, north of the mouth of the Hudson, with the lower part south of that point. Describe the tide water region. The coast from the St. Lawrence basin to the Florida peninsula. Why are the harbors south of the Hudson very few and very poor? Where do you find the harbors south of the Hudson? What are the principal river basins in this slope? To what purpose are the rivers north of the Hudson adapted? What parts of the courses of the rivers south of the Hudson are adapted to manufacturing purposes? Why? In the study of United States

history you will learn how very important a knowledge of this slope is. This long, narrow depression (pointing), containing Lake Champlain and the Hudson river, was the scene of several battles. Here are Fort Ticonderoga, Saratoga Plains and Stony Point. The Potomac breaks through the Blue Ridge at Harper's Ferry here. Do you know anything about Harper's Ferry? What do you know about James river? What is Florida? (peninsula.) How was it made? Tell pupils about the swamps, everglades, keys and reefs.

Alabama system of river basins. This slope is in reality an extension of the Atlantic slope, broken by the peninsula of Florida. Bound. Describe. Of what river basins does this slope consist? In what direction do the rivers flow? Describe the upper part of the slope. What is the soil of the lower part of the slope? How do you think this comparatively level plain was formed? Tell pupils about the Gulf stream; draw it.

Texas system of river basins. (This includes the slope of the plateau of Mexico.) Bound. What river basins make this slope? Which is the largest river basin? Describe the Rio Grande river basin. The staked plain. Why are the rivers very short south of the Rio Grande basin? Compare the Texan system with the Alabama system.

The Pacific river basin system. Bound. Describe

the upper part of this slope. The Sierra Nevada mountains. The great plateau. The enclosed basin. Describe the lower part of the slope. What mountains keep the ocean from washing the base of the Sierra Nevada range? What are the principal river basins that form this slope? Describe the basin of the Columbia. The basin of the Colorado. Show pictures of the canyons. Describe the Sacramento and the San Joaquin basins. In the united valleys of these rivers is the fertile land of California. Compare this system with the Atlantic system. What are the most prominent differences? If this great slope formed the eastern part of North America, what do you think the effect would have been upon the early settlements?

Review of the structure of North America. Name the natural divisions of North America. Which is the largest? The smallest? Bound the primary land mass. Bound the secondary land mass. Review the boundaries of all the natural divisions. Be sure to have pupils bound from their *mental pictures* and not from memorized words. In which two natural divisions do you find the most resemblances? In which two the greatest differences? Which one contains the most fertile land? Which the most barren land? Which natural divisions have the highest water-partings? Which the lowest?

Highlands are surfaces 1,000 feet above the ocean level; lowlands are, of course, surfaces below 1,000 feet. Draw a map and color it to show highlands and lowlands. Of what do highlands consist? Mountain ranges, plateaus and the upper parts of long slopes or *terraces*. Of what do lowlands consist? Generally of plains. There are often hills and low mountains in lowlands. The Ozark mountains are below 2,000 feet in height. Describe the western highlands; the eastern highlands. From what point to what point could you make the longest journey on lowlands in North America, traveling in one general direction? How many great plains are there in this continent? One. The valleys of what river basins form this plain? If the Atlantic and the Gulf of Mexico should rise 500 feet, what parts of North America would be flooded? See physical map. What two large islands would be formed?

Continental islands. Mold with continent West Indies, Bahama islands, New Foundland, Cape Breton island, Prince Edward's, Anticosti, Queen Charlotte's and Vancouver's islands. How do you think these islands were formed?

Rivers. What rivers are useful for commerce? What for manufacturing? Name the longest river. What rivers flow in their entire course through highlands? What rivers flow their entire course through

lowlands? What large rivers rise in highlands? In lowlands?

Have pupils mold North America; draw it, putting in all the natural divisions; then have them write very carefully a description of the continent. In writing descriptions train them to write.

Climate and soil. Without going much into details, teach pupils something of heat and cold, the changes from one to the other, and the causes of the changes. Also teach the direction and changes of the winds; the evaporation and condensation of moisture; the rainfall and all the essentials in climate which assist vegetation. Lead pupils to discover, through the structure and climate, the different kinds of soil. Where is the very fertile soil? What is alluvial soil? Where is the fertile soil? Arable soil? Barren soil? Tell the causes of each kind of soil. In what part of the Mississippi basin do you find the most fertile soil? Why? Why is not the lower part of the Atlantic slope as fertile as the lower parts of the Mississippi slopes? Slopes of what kind deposit great quantities of alluvium? Why?

Vegetation. Give lessons upon the principal vegetable products used for: 1. Food. 2. Clothing. 3. Shelter. 4. Manufactured articles. 5. Medicine. 6. Fuel. 7. Luxury. Have pupils tell you,

first, of all the staple food plants. Which food plant is used the most? Why do you think so? What plant stands next in order? Next? How is wheat prepared for use? Corn? Have pupils find localities (areas of land) best adapted to raising wheat, corn, rye, oats, barley, grass, potatoes, sweet potatoes, peanuts, sugar cane, sorghum, beans, peas; fruits, like the apple, peach, orange, fig, grape, etc. What kind of soil is adapted to each? Draw a map on the board and write the name of each product upon the locality where it is raised. What plants are used for clothing? Where is cotton raised? Sea island cotton? Where are flax and hemp raised? How is cotton cloth manufactured? Where is it manufactured?

Before the subject of shelter is taken up, it is necessary to examine the mineral wealth of the continent. Tell me all the materials used for building purposes. Write the list. What kind of material is used the most? Discussion. What kinds of wood? Locate the forests on the map. What are the principal woods used in building? Where do you find the most pine? Oak? Maple? For what are maple trees used except for building and fuel? Name the articles of house furniture. Write list. Of what are they made? Tell pupils of the great trees of California, the pines of Michigan, Maine and the Southern Atlantic coast, and of the live oaks and palmettos. For what purpose is cedar used?

What are the ornamental woods? Where are mahogany, rose wood, gum wood, black walnut found?

What kinds of minerals are used for building? What mineral is the most used? How are bricks made? Of what use is clay, except in making bricks? What kinds of stone are used? How is building stone quarried? Draw a map and locate minerals. Have specimens of woods and minerals. Where is granite found? Limestone? Marble? (Of what is marble composed?) Slate? Sandstone? For what is limestone used? Name all the metals. Have specimens. What metal is used the most? Locate iron mines. Give me all the uses of iron. How are railroads built and equipped? What is steel? What is the Bessemer process of making steel? For what is copper used? Tin? Zinc? Quicksilver? Locate all the useful metals. How are they mined? Show pictures. What are the precious metals? Describe the gold and silver mines of the Pacific slope, and the different kinds of mining; hydraulic, cradle, mining quartz, etc. The map should show by different colors the areas in which each mineral is found. What materials are used for fuel? What is coal? Tell the story of the "Stored up Sunlight." Show specimens with ferns, etc. What are the different kinds of coal? Mark off the areas where coal is found. In what localities are iron and coal found? Why is it very important to find them to-

gether? Visit a rolling mill if convenient. Describe the iron furnaces and coal mines of Pennsylvania. What is petroleum? Where is it found? How obtained? What is gas? How is it made? What is natural gas? Where found? Tell pupils how natural gas is conveyed long distances in pipes to be used for heating, cooking, etc. Write a list of the most important manufactured articles. What article used with food is found in mines? How is the salt made that is not found in mines? For what purposes is paper used? Of what materials is paper made? How is paper made? Tell pupils of paper car wheels. What plants are used for luxury? Where is tobacco raised? Coffee? Raisins? What plants are used for medicines?

Animals. Write a list of all the wild animals you can think of. Write a list of domestic animals. What domestic animals are used for food? What wild animals are used for food? What animals are raised for food? Draw map and indicate the localities where the animals live. The flesh of what animals is used the most for food? Tell pupils of the buffaloes of the prairies and how they have disappeared; of the great cattle and sheep ranches of the West; of hog raising and packing houses; of the fisheries on the Great Bank of New Foundland; of the salmon fisheries of Oregon and Alaska. What staple articles of food are furnished

by the hog? What other articles are manufactured out of bristles, bones, etc.?

Name all the animals used for clothing. What animal gives more in the way of clothing to man than any other? How is wool manufactured? What articles are made of wool? What kinds of hair are used for clothing? Name all the kinds of skins that are used for clothing. For what article of clothing is the greatest quantity of skins used? The skins of what animals are used to make leather? How is leather manufactured? What articles except boots and shoes are made of leather? What do birds do in the way of helping us to clothing?

Name all the animals used for transportation. What animal is used more than any other for transportation? What is the most useful animal for transportation next to the horse? Describe the horse ranches of the plains.

Political divisions. The best way to teach the political divisions is to wait until the structure of all the continents has been taught and then teach them all together. The history of the United States is taught in this grade, and all special political geography should be taught in connection with that subject. Boundaries, cities, colonies, states, should be taught as the subject is developed. Before leaving the structural teaching of

North America, the political boundaries of the Dominion of Canada, United States, Mexico and Guatemala may be profitably taught. Indicate boundary lines by putting a colored thread upon the molded map. Draw the map on the board and mark off the boundary lines by red crayon. Over what do the boundary lines run? Where do political boundaries coincide with natural lines? What is a political division? What is the use of a political division? Tell the government of each. Describe, by writing, (pupils) each political division; highlands, lowlands, mountains, plains, river basins, lakes, rivers, coasts, coast line, climate, soil, vegetable products, minerals, natural advantages for commerce and manufactures. These descriptions will be an excellent test of how well *you* have taught the continent. The usual form of map questions may be used very profitably, *providing pupils answer from mental pictures and not from memorized words.* When there is any indication of this fatal habit, change your questions so that pupils will be compelled to think of the reality. Where is Hudson's bay? Isthmus of California? Locate the Sierra Nevada mountains; the Hudson river, Lake Superior, etc., etc.

Language. It seems needless to refer to the innumerable opportunities presented for teaching language, both oral and written. The habit of perfect accuracy

should be cultivated by training pupils to be accurate in every sentence, written or spoken. Each new word should be written on the blackboard in *the best hand writing* the moment your pupils obtain the appropriate idea. *Have many written descriptions.* Train pupils to describe from their own mental pictures. Have them *give the general first,* following it with the main particulars in the general. Train pupils to use the dictionary and to know when they do not know a word, and never to write a word unless they know its meaning. Put simple rules for punctuation and use of capitals on the board and have pupils apply them. *If a paper has a single mistake upon it, hand it back and have the paper rewritten.*

If pupils write in a painful, cramped hand, they will never enjoy writing; the beautiful, graceful and easy arm-movement should always be used.

Number. Teachers can get a glimpse from the foregoing suggestions of the great necessity for using numbers in measurement and comparison of measurements in developing their pupils' ideas of distance, heights and areas. Many problems should be made involving such measurements. There is no use in *memorizing* distances and areas; the problems, if properly used, will be sufficient.

Drawing. Have pupils draw continually. A good

test of your teaching would be to place on the wall (for the first time) a good physical map, after the continent has been taught, and have pupils describe the continent from the map. Stanford's and Guyot's are the best physical maps now in use.

Reading. A carefully selected list of reading matter is given elsewhere. Guyot's Common School Geography is the best text-book on geography to read with the study of structural geography. A great part of the reading may be profitably given to descriptions of the continent taught.

SOUTH AMERICA.

The best test of the power acquired by the teaching of a subject is the zest and ability with which pupils take up the succeeding step. If North America has been well taught, it will furnish both the power and the means of studying all the continents. Test your pupils by placing a well-molded map of South America before them, and have them analyze and describe it, giving them the names as they discover the natural divisions. Ask questions only as pupils need them to quicken their observations.

If this plan should fail, try the one given in Notes Upon North America. Mold the continent. Where is the continental axis? Trace it. Compare it with the continental axis of North America. Into what does it

divide South America? Compare the short slope of South America with the short slope of North America. Which is the longer slope? (east and west.) What in North America resembles Chili? What resembles Patagonia? To what in North America can you compare the Isthmus of Panama? The western coast of Patagonia has many islands that once formed a part of the mountain range; what resembles this in North America? What is the greatest difference between the two short slopes? Give any other differences. Draw the Pacific coast line of North America and near it the Pacific coast line of South America. Compare. Compare the long slope of South America with the long slope of North America. Give all the resemblances you can. Have pupils see resemblances without assistance; if they do not, ask questions such as the following: Compare La Plata basin with the Mississippi basin. Main tributary of Panama, on left slope, with the Ohio. Amazon basin with St. Lawrence basin. Madeira basin with the Missouri basin. Marajo island with New Foundland. Orinoco with Mackenzie. Gulf of Venezuela and Lake Maracaibo with Hudson's bay. Brazilian river basin system with the Atlantic river basin system. Guiana system with the Labrador-Atlantic slope. Guiana slope with the Atlantic slope south of Hudson river. Patagonian system with the Texan system. Magdalena river basin with the Yukon

river basin. Compare the great western highlands of the two continents. Length, 4,550 miles; how much longer are the North American highlands? What have the Andes to compare with the parks of the Rocky mountains? Compare the Brazilian highlands with the Appalachian highlands. Guiana highlands with the Labrador highlands; with the Appalachian highlands. The Atlantic coast lines of the two continents. The coast line of the Caribbean sea with that of the Arctic ocean. The lesser Antilles with Baffinland. The great central plains of the two continents. South America is 3,200 miles broad; what is the difference between the breadth of South America and North America? Name ten resemblances between North America and South America. Name ten differences. By these comparisons, if skilfully conducted, the pupils will soon acquire a clear picture of South America. A detailed study may be made as suggested in studying North America. In teaching, mold each natural division as the study proceeds.

Long Slope.	Amazon basin. La Plata basin. Orinoco basin. Brazilian system. Guiana system. Patagonia system. Brazilian highlands. Guiana highlands. Great Central plain.

Short Slope.
- Coast ranges.
- Slope of Patagonia.
- Slope of Chili.
- Desert of Atacama.

Andes Mountain System.
- Ranges.
- Knots.
- Peaks.
- Volcanos.
- Enclosed basins.
- Source of Amazon.
- Magdalena river basin.
- Maracaibo basin.

Bound, describe, mold, draw, write.

The story of the Incas and the Conquest of Peru by Pizarro may be read to add interest to the study of the Andes. Tell pupils about the mountain knots and valleys in the Andes, about the silver mines, etc. Describe the three divisions of the great central plain; llanos, selvas and pampas. Mold the basin of the Orinoco. Describe the right slope. A mountainous slope; the river runs close to the Guiana highlands. Bound the left slope. Compare the surface of the left slope with the surface of the right slope. The lower part of the left slope is a very large level plain. It was once, they say, the bottom of a gulf. The ocean flowed in here (pointing) and flooded this depression or valley. Slowly the ground-up rock (silt) was washed down from the mountains on every side by the rain, the brooks and the rivers, and up from the ocean by the waves and the tides until the land was

raised above the level of the sea. By and by the marsh grasses, bulrushes and flags began to grow and the land grew firmer. Then meadow grass and flowers sprang up, and the bottom of the gulf became a vast plain covered with tall grass and bright flowering plants. It is very warm here; indeed it is hot, for the great sun shines, twice in the year, right over the plain. We say that the sun's rays are *vertical.* What is a vertical line? The great heat of the vertical rays takes up from the ocean into the air (evaporates) a great quantity of water, which becomes so heavy up in the clouds that it tumbles back in rain. The rain gives the grass roots plenty to drink and they grow fresh, green and tall. Vast herds of horses and cattle fatten upon the grass and run and gallop over the plains to show how happy they are. The great river is swollen by the floods and thousands of alligators play in its waters. Tortoises are as plenty as blackberries; they lay their eggs in the muddy bank for the hot sun to hatch. All is full of life and joy. Then the sun moves away from overhead. The rays slant a little and the rain ceases to fall. What happens then? The grass, with no water to drink, dries up; the vast plain becomes brown with dead grass; the poor horses with no grass to eat, no water to drink, run from place to place, their tongues lolling, seeking in vain for food and water. Thousands of them fall down and die, leaving their bones to bleach

in the torrid sun. The swollen river grows smaller and smaller, leaves its banks and flows over a far narrower bed. The alligators and tortoises are fastened securely in the hard, dry mud and all is still—still as death, waiting for the vertical rays to come again and give them water and life. The sun comes; slowly over head the ball of fire moves; the rain pours down again; the grass springs up; the horses neigh for joy; the huge creatures open their eyes and crawl out of the mud. Everywhere is teeming life.

A description of the forests of the Amazon would interest pupils. The tangled woods, tropical plants, the caoutchouc tree and the gathering of the gum, the monkeys, parrots, etc. The pampas with its tall grass and vast herds of cattle; Brazil with its diamond mines and coffee plantations; Patagonia and the Land of Fire; Guiana with its building coasts; the llamas and condors of the Andes; the wonderful Cassiquiare river; the portages between the basins of the Amazon and the La Plata are all very interesting subjects and descriptions of them will assist in making the mental pictures of the structure clearer.

Follow the same plan as in North America in regard to teaching climate, soil, vegetation, animals, mines and manufactures. Draw a map on the board and divide the continent into its political divisions; have pupils describe the structure, river basins, climate,

soil, vegetation, mines, advantages for commerce and manufactures of each division. Compare Brazil with the United States; the Argentine Republic with Mexico; Chili with California. Draw North America and South America in their relative positions and then compare them.

Elementary lessons in physics should be given in this grade; lessons upon air, water and heat, such as evaporation, condensation, movements of air (winds), density of air, deposition of sediment, effects of frost, erosion, etc.

SIXTH GRADE.

Review very thoroughly all previous work.

EURASIA.

Europe and Asia, forming one continent, should be taught as one great mass of land. It is far more difficult to teach than either North or South America owing to two facts; (1) the land mass is in itself more complex; (2) comparatively little of the highest parts of Asia is accurately known. It is not easy to trace the continental axis, as this line from Bering strait to the Pamir has not been topographically surveyed. Authorities differ in many particulars. Mold the map of Eurasia and indicate, in sand, the continental axis.

The following description is presented as a guide to the teacher's study in preparing lessons.

The continental axis. Rising out of the Frozen Ocean at Bering strait, hardly thirty-six miles from the American continent, is the beginning of this long axis, extending 10,000 miles from East Cape to Cape Finisterre (end of the land). It is nearly as long as the continental axis of North and South America taken together. From Bering Strait it is borne on the crests of the Stanavoi and Yablanoi ranges (Yablanoi means apple tree) for a long distance. These ranges extend in a southerly direction, skirting the sea of Okotsk and turning a little toward the west.

Just west of the mouth of the Amur the Yablanoi mountains run along the coast of the sea of Okotsk about 600 miles. One branch of these mountains joins the Altai, while another, broken by the basin of the Amur, extends to the south. This branch or range is called, south of the Amur basin, the Great Kingan; there are probably many other names. South of the Amur basin the Kingan mountains form the western enclosing wall of the great central plateau and the upper part of the slope toward the coast line of the Pacific. The Chinese wall crosses it and runs for 400 miles upon its eastern flank. Through this range breaks the Golden river (the Hoang-Ho). This range extends in a southwesterly direction for nearly 1,500 miles from the

Amur basin, where it joins the mighty mountain range which extends nearly due west from the Pamir (the Roof of the World). This massive range is called the Kuen Lun. From the Kingan, or the southern extension of the Kingan, the Kuen Lun range runs west for more than 1,500 miles, when it comes to that meeting of mountain ranges, the Pamir. The Kuen Lun walls in the high plateau of Thibet and separates it from the vast plateau of Gobi on the north — 1,500 miles of snow, ice and towering peaks. It has been supposed for a long time that the Himalaya range supports this continental axis, but later explorations show that the Kuen Lun range has that honor. It has a higher average height than the Himalayas. The Kuen Lun, Himalaya and Thian Shan ranges come together and form an immense mass of mountains, the Roof of the World. From the Pamir the Hindu Kush, a range worthy of the Pamir, pushes its way toward the west and then sinks down in a comparatively low mountain range until it rises in the great Mount Demavend, just south of the Caspian sea. The mountains over which the continental axis runs, from the Pamir to Asia Minor, form the northern wall of the plateau of Iran and the Armenian highlands. There is a question about this line of the continental axis; some authorities would send it south from the Pamir along the Solyman mountains to the Arabian sea and then east on the southern rim of

the plateau. As the mountain range (Elburz and Taurus) enters the peninsula of Asia Minor it seems to bend to the south, where it slopes directly into the Mediterranean sea. Just at the foot of this slope (pointing) Alexander the Great nearly lost his whole army trying to pass between the mountains and the sea. The mountains of Asia Minor sink into the Ægean sea, rising again into many beautiful islands. Just where the continental axis runs from the Taurus to the Balkan mountains is not known. The Dardanelles break the continuity of the mountain mass, but only for a very short distance. (Stories of Leander and of Xerxes.) The Balkan mountains take up the continental axis west of the Dardanelles, and joining the Dinaric Alps reach the great highland of Europe, the Alps. It is nearly 800 miles from the Dardanelles to the eastern terminus of the real Alps. This great mountain mass trends toward the west and then curves toward the south, forming a mighty arch that protects Italy from the cold north winds and from invading hordes. The continental axis runs over the southern rim of these highlands, which overlook the rich fields of the Po. The Alps curve toward the south and send off a long spur or branch, which runs down in a southwesterly direction into the Mediterranean sea, forming the boot-shaped peninsula of Italy. The continental axis sinks into the basin of the Rhone, to rise again in great prominence

in the Pyrenees, which form the northern protecting buttress of the peninsula of Spain. The range of the Pyrenees extends westward in the Cantabrian range, which projects out into the Atlantic and forms Cape Finisterre (the end of the land). Trace the continental axis of America and Eurasia from Cape Horn to Cape Finisterre; give the mountain ranges over which it runs. Compare the continental axis of America with the continental axis of Eurasia. This continental axis divides Eurasia, as you see, into two great slopes. How broad is each slope? East and west? Compare the long slope with that of South America. With the long slope of North America. Compare the short slopes.

The Highlands of Asia. You see, at once, how this immense land mass differs from the primary high land of the Americas. The main difference, however, is in breadth and height. We will begin on the Roof of the World (Pamir). Here the great mountain ranges of Asia have a grand meeting, narrowing the immense highland to something like an isthmus. On the south the land sinks into the basin of the Indus; on the north into the basin of the Amoo Daria (the ancient Oxus). From the Pamir the snow-crowned Himalaya range extends toward the east in a magnificent curve, presenting its arc to the basins of the Indus, Ganges and Brahmaputra, while its convex side walls

in the loftiest and grandest plateau of the world, Thibet, which is from 10,000 to 11,000 feet above the level of the Indian ocean. The mighty curved wall of the Himalayas is the southern buttress of Thibet. Through these towering, snow-clad mountains three great rivers make their way, gathering the ice-cold waters from the northern slope of the range. The Indus breaks through at the western end of the plateau, after flowing 450 miles along the base of the northern slope. The Sutlej or Ghara, a tributary of the Indus, rises near the source of the Indus and plunges through the mountain wall 350 miles east of the place where the Indus reaches the plain. But the grandest plunge of all these remarkable rivers is made by the Brahmaputra, 200 miles from the eastern end of the plateau. The Sanpoo, the upper course of the Brahmaputra, rises near the source of the Sutlej and flows east under the awful heights of the Himalayas for more than 700 miles, then it turns toward the mountain which supplies its torrents and plunges over precipices and roars through the yawning chasms until it reaches the level plain below. The Ganges takes its floods from the southern slope of the Himalayas. You see that these immense mountains are something more than grand objects to behold; their snow-covered tops and vast rivers of ice make the hot plains of India capable of supporting many millions of inhabitants. Indeed, there is but little doubt that the

ground-up rock of the mountains, carried down by the swollen rivers, made the plain itself. The Himalayas guard some wonderful secrets. Very little is known of the people who dwell north of their icy walls, or of their mysterious religion. The secret of the Sanpoo was guarded for ages by a race of warlike men, living in the mountain fastnesses where the Sanpoo joins the Brahmaputra. It is only within a few years that this fact has been discovered.

The northern enclosing wall of Thibet is the Kuen Lun range, over which runs the continental axis. The northern slope of this range descends to the plateau of Gobi, at least 6,000 feet below the plateau of Thibet. From the western end of the latter plateau a vast range runs easterly nearly through the plateau. This range is called the Karakorum mountains. Thus we have the high plateau of Thibet enclosed by the Himalayas on the south, the Kuen Lun on the north and penetrated by the Karakorum range. Cold winds sweep this lofty mountain plateau, with little rain except that which the snow-capped peaks send down.

Now we will go back to the Roof of the World again. The united ranges which form the Pamir extend north for nearly two hundred miles. From this point the Thian Shan range sends out its great mountain mass toward the northeast. The Thian Shan mountains join the Altai mountains, and together they

form the northern enclosing wall of the great plateau Gobi. The Altai mountains join the Yablanoi range in the northeast. We should make a great mistake if we should imagine the Thian Shan and Altai to be a regular range like the Sierra Nevadas or the Andes. All the way from the Pamir to the Stanavoi mountains, the mountains which form the northern fringe of Gobi send out into the Siberian plain great mountainous peninsulas. Deep trenches are torn out of the flanks of the plateau edge like huge railroad cuts. It may be that the trenches were cut by the spring torrents that flood the river basins below and carry down immense quantities of bowlders, gravel, sand and torn up trees; or it may be that the waves of the Arctic ocean once made these trenches as the Atlantic is now cutting the fiords in Norway. The plateau of Gobi is much lower than Thibet; it is from 5,000 to 2,000 feet above the ocean level; a vast dreary waste of mountains, bowlders and sand. The plateau (Gobi and Thibet taken as one) is enclosed by the Himalayas on the south, Thian Shan and Altai mountains on the northwest, and the Kingan mountains close the triangle on the east. It forms a continent within a continent; and indeed, if you will look closely, you will observe its shape to be very much like that of South America.

The primary Highlands of Europe. The primary

highlands of Europe are in some respects the primary highlands of Asia in miniature. Put the Alps down at the southern base of the Himalayas and they would seem like foothills; take them alone as the highlands and they are very grand. We have already traced the continental axis. Rising from the Dinaric Alps that look down upon the waters of the Adriatic, the great mountain mass of Europe towers above the valley of the Po and the plateau of Central Europe. About 350 miles in extent and from seventy-five to 100 miles in width, these grand mountains, their tops covered with snow, their flanks furrowed with glaciers, form the protecting wall for Italy and furnish the fertile basin of the Po with plenty of moisture from their white crests. They form also the buttress of the plateau which extends north from the foot of their abrupt slopes. The Himalayas, you notice, curve toward the peninsula they guard, while the Alps curve from the peninsula of Italy. The Danube drains the northern slope of the Alps, Dinaric Alps and Balkan mountains from the Black Forest to the Black Sea. The Alps, like the Himalayas, have a plateau to the north of them. Just here (pointing), where the Danube breaks through the mountains, rises a range called the Transylvanian Alps, which curve and extend in a northwesterly direction under the name of the Carpathian mountains, then the range takes the names of the Sudetes mountains, Giant

mountains, Erz mountains (copper mountains), and lastly comes the famous Thuringian Forest. At the western extremity of the Thuringian Forest the mountains sink into hills, but you can trace them over the Main river, and where they form the upper part of the right slope of the Rhine, down to the Black Forest, in which the range rises again to join across the Rhone the famous Jura with its deep transverse gorges. On the opposite slope of the Rhine from the Black Forest are the Vosges mountains, which sink into hills along the right slope of the Rhone, rise again in Cevennes and form an acute angle with the mountains of Auvergne. The Transylvanian Alps, Carpathians, Sudetes mountains, Giant mountains, Erz mountains, Thuringian Forest, the connecting hills, the Black Forest and the Jura, the Harz north of the Thuringian Forest on the east, north and west, with the Alps, Dinaric Alps and an extension of the Balkans on the south, form the great enclosing wall or outer rim of the plateau of Central Europe. This plateau extends from the water-parting of the lower course of the Danube, in a northwesterly direction, about 700 miles to the Rhine; it is 250 miles broad. The eastern end is called the Transylvania Table Land. East of this table land the plateau sinks below 500 feet in the basin of the Theiss, a tributary of the Danube. This lowland in the plateau is nearly 250 miles long and 150 wide, including the

valley of the Theiss and a strip of the valley of the Danube. East of this lowland is the plateau of Bohemia, a Table Land shaped like a kite with its southern apex near the Danube. The Erz mountains, the Giant and Sudetes mountains form respectively the two sides of the northern triangle; the Bohemian forest and the Moravian mountains the longer sides of the southern triangle. The plateau of Bohemia is shut in by mountains. Here is Austerlitz, here Wagram; not far off on the Iser is Hohenlinden; north is Dresden and northeast Jena. With what terrible battles had these mountains to do? You must understand the structure of a country before you can understand how great armies march and where they must fight. The structure is the key to the whole situation; for instance, up the valley of Blue Danube came the vast hordes of Asia, which once conquered and laid waste all Europe. The eastern end of the plateau of Central Europe may be called generally the plateau of Bavaria. The Danube basin includes by far the greater part of the plateau of Central Europe. The Elbe breaks through the apex of the northern triangle of the "*kite;*" the Weser takes the water from the northern slope of the Thuringian Forest; the Rhine drains the southern and western slopes, the mountains and hills including the Black Forest. The upper course of this beautiful river plunges between the Black Forest and the Jura, taking its waters

from the southeastern part of the Bavarian plateau. The Rhone rises in a glacier between the southern and higher range of the Alps and the Bernese range, dashes down a dark valley between lofty mountains, spreads out in Lake Geneva, and then pours its waters down between the Jura and the principal range of the Alps, where, joining the main river, it takes the waters on its right slope from the Cevennes, broadening and deepening until it reaches the Mediterranean.

Compare the Alps with the Himalayas; the plateau of Central Europe with Thibet and Gobi.

Long slope of Eurasia. The continental axis divides Eurasia into two great slopes; the slope to the north we call the long slope. It is much easier to analyze this than the shorter slope south of the continental axis, for there is one great plain from the hills west of the Stanavoi mountains to the base of the Pyrenees, almost ten thousand miles. Ten thousand miles of plain, two-fifths of the distance around the globe! This vast plain is shaped like a triangle, its base being the coast line of the Arctic and Atlantic oceans, its southern apex nearly where the Russians have lately pushed a railroad out into the desert, Merv. Would it be too great a stretch of fancy to say it looks like a mighty eagle with out-spread wings; the feet, one on Demavend, the other on Hindu Kush; the tip of its

right wing at the base of the Pyrenees and the tip of its left wing touching the Stanavoi mountains; its backbone and neck the Ural mountains, while its head is Nova Zembla? This great northern plain of Eurasia may be divided into three parts, (1) the plain of Siberia; (2) the great depression or the basins of the Black, Caspian and Aral seas; (3) the plain of Northern Europe.

The plain of Siberia. The Ural range separates the plain of Siberia from the plain of Northern Europe; the water-parting of the Aral and Caspian basin is the line of division of the plain on the southwest; the Thian Shan, Altai and Yablanoi mountains enclose the plain on the south and the coast line of the Frozen Ocean on the north. The plain of Siberia consists principally of the basins of the Obi, the Yenesei and the Lena, three vast river basins. Between these basins and east of the Lena basin are the basins of a large number of smaller rivers, which flow into the Arctic ocean. The Obi basin (1,360,000 square miles, length 2,674 miles), the Yenesei basin (999,000 square miles, length 3,688 miles), the Lena basin (775,000 square miles, length 2,766 miles), cover a surface of 3,134,000 square miles and aggregate in length 9,128 miles. Thus the surface of these basins is almost as large as the whole of Europe (3,928,252 square miles), while the

whole country, including the smaller rivers and islands, is 4,826,168 square miles, or 897,916 square miles larger than Europe, and 1,223,178 square miles larger than the United States. The population, however, is not so great as the State of Pennsylvania (4,282,891); the population of Siberia is only 3,911,200. Why is this? The Siberian slope may be divided into three parts corresponding to the three courses of a river; (1) upper part; (2) middle part; (3) lower part. The mountains open their broad and deep ravines or trenches into a comparatively fertile, well-wooded plain. The upper or southern part of the plain is inhabitable, the middle part is a vast, cold steppe, the lower part consists of immense level frozen swamps or *tundras*. The lower courses of the three great rivers are frozen except from seventy-six to one hundred days in the year. In summer the returning sun thaws the snow and ice upon the mountains, and immense floods swell the mountain lakes and streams and dash and roar down through the trenches, taking with them vast quantities of earth, bowlders and torn up trees; the frozen mouths obstruct the river courses and the *debris*, the spoils of the flood, spread out over large areas; the frozen rivers open their mouths under the influence of the warmer sun, the freshet pours out into the ocean, leaving the products of its devastation to cover the land. The water-partings between the river basins are very low;

in fact, one can travel in boats from the basin of the Aral sea nearly to the water-parting of the Amur by drawing the boat over short portages.

The basins of the Black, Caspian and Aral seas. This vast basin, taken as a whole, extends from the Pamir to Black Forest, east and west; from the continental axis at the foot of the Caspian sea to the low water-parting which divides the northern plain of Europe and this basin. The continental axis of Eurasia is its southern water-parting with the exception of the *divide* on the Caucasus mountains; the northern boundary runs from the Black Forest, in a very irregular line, over the water-parting of the left slope of the Danube basin, and then over the divide of the Carpathian mountains, in a northeasterly direction over the water-parting on the Valdai hills to the Ural mountains, where the water-parting of the Irtish takes it up and carries it to the continental axis again. Most of this vast depression, with the exception of the basins of Amoo Daria and Sir Daria, slopes generally toward the continental axis. This region has a marvelous geological history. It may have been, one day, that this enormous depression, like the plain of Siberia, sloped toward the northern ocean, borne upon the shoulders of high mountains, which extended from the Pamir to the Balkans, and of which the Caucasus is left as a monu-

ment. Who knows? The southern slope of this depression is very short, excepting the slope toward the Aral sea. The Alps form the right slope of the Danube; the Anti-Taurus turn the waters of their northern slope into the Black sea; the northern slope of the Caucasus gives its waters to the Black and Caspian seas; the Elburz slopes abruptly to the Caspian sea; the Amoo Daria (Oxus) takes its current from the Pamir and Hindu Kush; the Sir Daria from the Thian Shan. The northern slope, of this great combination of basins, consists of à magnificent river basin system, beginning in the west with the Blue Danube, which drains the plateau of Central Europe, followed by the basins of the Pruth, Dniester, Dnieper and Don, with several smaller intervening basins.

But the climax of river basins is reached in the mighty Volga, that depends less upon mountains for its floods than any other great river in the world; joined on the east to the Volga basin is the basin of the Ural, and then the depression narrows and the water supply comes from the southeast. The greater part of this basin has no outlet into the ocean. Where do the waters of the Caspian and Aral seas go? There are many exceedingly interesting facts about these great inland sea basins; interesting in structure, history and the prospects of future development. The black earth north of the Black sea, which rivals the Mississippi

valley in the production of wheat; the broken and destroyed irrigating ditches and canals of the Amoo Daria, which make that river second only to the Nile in its capabilities of making land fertile; the open way over level land from near the gates of India to the western entrance of Central Europe and up the Danube, is the Black Forest, a route by which Asia gave Europe its conquerors, inhabitants, religions and civilization; all these tell of the direct relation of structure to the progress and development of mankind.

Then the *future;* millions of square miles of arable land are kept from productive farming, and the making of happy homes, by the vast hordes of savage and half-civilized nomads (pasturing people) that have wandered for ages over the basins of the Amoo Daria and Sir Daria, and away to the west over the vast steppes of Siberia. There is no chance to cultivate a farm or make a nice home when any morning a fierce band of Tatars of Kirghis may appear, kill or drive you away and feast their herds upon your growing crops. For countless ages this has been the case over far more than half of Eurasia. People can never become civilized unless they have *homes,* and you will find that permanent homes were possible in earlier ages only where the Creator had walled in by mountains and deserts some fertile portions of this great world like Palestine, Egypt, Greece, Italy, Spain and India,

or had separated land like Great Britain from the continent. Now the great civilizer of mankind has come, the Iron Horse, and to-day the steam engine takes Russian bayonets from the shores of the Caspian sea to Merv; to-morrow, or within twenty years, no doubt, trains of cars will take millions of poor emigrants from the over-crowded cities of Europe and China and scatter them all along the arable tract from the Caspian sea to the Amur basin. The trained armies of Russia will make the nomad life unpleasant, and the fierce cowboy of the steppe will settle down to farming. Much of the land which should supply hungry mouths with plenty of food is kept from cultivation by the nomad and the aristocrat—the uncivilized and the ultra civilized. Which is the worse?

Northern Plain of Europe. We now come to the third great division of the Eurasian plain, bounded on the west and north by the coast lines of the Atlantic, the English channel, North sea, Baltic sea, Gulf of Finland, divide of Finland and the coast line of the Arctic ocean. Its western boundary is the divide of the Ural mountains; the southern boundary we have already traced, with the exception of the line over the depression between the Alps and the Pyrenees. This plain stretches from the Ural mountains to the Pyrenees, nearly 2,500 miles; it is nowhere much more

than 400 miles wide; it is the narrowest where the Valdai Hills slope toward the Gulf of Finland and widest at its eastern termination. It is, in fact, one regular slope, the highest part of which is in the western portion of the Alps, where the Rhine takes its waters. The northern slope of Europe consists of a large number of river basins, divided by very low water-partings. Beginning at the Pyrenees we have the Garonne basin, the Loire, the Seine, the Rhone, the Weser, the Elbe, the Oder, the Vistula, the Nieman, the Duna, the short Neva, the Onega, the Dwina, and Petchora basins. You need not learn the names of these rivers, but it is important to know their situation and structure, as many of their basins, like that of the Rhine, have played a very important part in history. The rivers of northern Russia, in Europe, creep over low plains to the ocean, while the upper courses of the other rivers flow swiftly down the abrupt slope. The Rhine is the longest and grandest of them all. It takes its waters from the northern slope of the Alps, spreads out in Lake Constance, breaks through the ranges of the Jura and Black Forest, turns abruptly to the north, flowing through beautiful mountains until it reaches the broad alluvial plain. Look closely, for every square mile of this basin is crowded with wonderful events in history.

The slope of Northern Europe may be divided like the

long slope of Asia, into three divisions, upper, middle and lower. The upper part is filled with forests on the flanks and terraces of the mountains; the middle consists generally of low fertile hills; the lower has the same formation as the tundras, flat, alluvial and swampy land. The shores of the Baltic generally consist of sand dunes and swamps; the flat, alluvial peninsula of Denmark stretches toward the Scandinavian peninsula; the swamps of Oldenburg, the mud walls of flat Holland and the marshes and billowy sand hills of the Landes are characteristic of the lower part of the slope.

Three areas on the long slope remain to be mentioned; (1) the great enclosed basin in the plateau of Gobi; (2) the Scandinavian peninsula; (3) Great Britain. Very much of the surface of Gobi is not drained, at least by surface water, into the ocean; the great Tarim river drains the eastern slope of the Pamir, flows east and sinks into the Lob Nor, a marshy lake. Compare with Humboldt river. The enclosed basin cannot now be bounded, as very little is known of how much surface the rivers on all sides, that flow to the oceans, drain.

Scandinavia is separated from the northern slope of Europe by the low granite floor of Finland. A well defined axis (nearly 1,000 miles long) divides the peninsula into a long and a short slope; the long slope is drained by many short rapid streams; the short slope presents a rocky barrier to the fury of the waves of the

north Atlantic, which, with glaciers, have cut for miles inland long, deep, narrow ravines or gorges called fiords. Brittany is formed of low mountains, jutting out into the Atlantic between the basins of the Loire and Seine. Great Britain, with Ireland, seems like a broken continuation of the Scandinavian range, while the English channel makes another break in the continuity by separating Great Britain from Brittany. The narrow straits of Dover have done more to make England a mighty nation than all the monarchs from King Alfred to Queen Victoria. Great Britain, like Scandinavia, has one axis running north and south through Scotland and England, dividing it into a long and short slope, while mountainous Wales seems to be a repetition of Brittany. Ireland has a special structure, differing from the structure of most large islands. It has a rim or fringe of highlands, while the inside of the coast rim is filled for the greater part with lowlands. Compare the plain of Eurasia with the plain of North America; with the plain of South America. The rivers of Siberia with the Mackenzie. The Danube basin with the basin of the St. Lawrence. The Volga basin with the La Plata basin. The plain of Siberia with the northern plain of Europe. The northern plain of Europe with the Atlantic slope of North America. The lower part of the plain of northern Europe with the tide water region on the Atlantic slope of North

America. Let pupils see resemblances and differences between any two natural features previously studied, *e. g.*, Rhine and Hudson basins.

Analysis of short slope of Eurasia. This slope, although comparatively short, is rich with peninsulas, mountains and river basins, and still more rich in history. We will begin by molding this slope at the northeastern corner of Eurasia. Here we find a long, lance-shaped peninsula, Kamchatka; it extends to the south 800 miles, then the mountain range which makes the peninsula, partially submerged by the Pacific, seems to extend the whole length of the eastern coast of the continent.

First, we see the long curve of the Kurile islands, with a multitude of mountain tops rising out of the ocean; second, the Empire of Japan, Yesso, Niphon, Kiusiu and Sikokf, great mountainous islands; third, the Loo Choo islands curving like the Kuriles; fourth, Formosa, followed by a great archipelago called the Philippine Islands; fifth, the great island of Borneo; then there rises what seems like an immense submerged continent.

Now we will go back to Kamchatka again. Here is the sea of Okotsk, shut in by Kamchatka and the Kurile islands, with the inner walls of the Stanovoi or Yabolonoi mountains, over which the continental axis

runs. Here is the Sagalien island, long, narrow and full of mines.

Just here at the head of the strait, which separates Sagalien from the main land, the coast line makes a long curve outward, walled by a coast range which bends inward opposite Niphon, and then follows the coast for 300 miles or more, curves toward the east, and running out into the ocean forms the peninsula of Corea, which is 350 miles long; it looks like Florida, but it is much larger. The Japan islands shut in the Japan sea, which is shaped something like a long pear, its stem formed by the Gulf of Tartary. The coast range here slopes toward the great basin of the Amur; the river is turned to the north by this range. The country on this slope is called Manchuria and it consists mostly of the basin of the Amur. Between the Corea and the mouth of the Yang-tse Kiang is a very long and deep indentation called the Yellow sea, shut in by Kiusiu, one of the Japan islands, and the Loo Choos. The Shantung mountains send a peninsula into the Yellow sea and aid in walling in one of the most wonderful alluvial plains in the world. This plain is a delta; it was made by the silt brought down from the Hoang Ho and the Yang-tse Kang rivers; the former, however, has had the most to do with it. These are two remarkable rivers; their united basins cover an area of 1,085,200 square miles. The Hoang Ho rises (they say) in the

eastern part of the Kuen Lun mountains and flows for 2,200 miles in the mountains. The delta is crossed and recrossed by a system of canals.

One hundred miles south of the mouth of the Yang-tse Kiang begins another curve, very much like the curve which forms the inner boundary of the Japan sea; it curves to the south for nearly 1,000 miles and ends in a short peninsula, which, with the island of Hainan, very much resembles the peninsula of Corea. This curve, like the one on the Japan sea, is formed by a coast range which sends many rivers to the sea from its outer slope; the inner slope gives its waters to the Yang-tse Kiang. The island of Hainan and the short peninsula partially enclose the Gulf of Tonquin, which is an arm of the China sea, shut off from the Pacific by the Philippine Islands.

We now come to the first of six wonderful peninsulas, all trending toward the south, all mountainous, and all but one have been the nest-places of civilization. This peninsula is formed of mountain ranges running north and south, with valleys between them, through which flow the Cambodia or Mekeong, the Menam, the Salwen and the Irawaddy rivers, all taking their waters from the southeastern base of the great plateau. One of the ranges, which make this peninsula, extends more than 900 miles farther south than the others, and forms the Malay peninsula, which, like

Kamchatka, is shaped like a lance, or perhaps you will think it looks like a great club; the people there are savage enough for both. Just over Malacca strait is the long island of Sumatra, which, like Ceylon and Sicily, seems to have dropped off from the end of the peninsula. Now we cross the broad bay of Bengal, which indents the continent as India projects into the Indian ocean; the peninsula and the bay seem like counterparts of each other. Here is the second of the great peninsulas, formed by the plateau of Deccan, walled in on the west by the steep Ghauts (gateways), high mountains, the upper part of a slope which inclines over a plateau eastward to the coast line; along the coast a low line of coast mountains keeps back the waves of the bay of Bengal. The Vindhya range partially walls the Deccan on the north. Just south of this range the land inclines eastward, and carries the Nerbudda 600 miles, and the Taptee 400 miles to the Arabian sea. The Deccan is shaped, you see, like a triangle. Enclosed by the Himalayas on the north, the Solyman and Hala mountains on the west, and the western wall of Indo-China on the east, is a vast alluvial plain. From east to west across the plain it is 1,900 miles; from the northwest corner of the plain to the base of the Vindhya mountains it is 800 miles. If the Indian ocean should rise 600 feet it would flood the entire plain to the base of the Himalayas, leaving the

Deccan an island. This plain consists almost entirely of the basins of three wonderful rivers, the Brahmaputra, the Ganges and the Indus; indeed, it is believed that these three rivers made the plain by bringing down silt from the mountains. The Ganges and Brahmaputra unite their deltas and form probably the largest delta in the world; it extends 200 miles inland and has a coast line of more than eighty miles. These two rivers bring down immense quantities of ground-up rock from the lofty mountains, sending a stream of colored water sixty miles into the bay of Bengal, although most of the sediment is deposited close to the shore, building the delta every year farther and farther out into this arm of the Indian ocean. Look just north of the Himalayas and you will see where the Brahmaputra and the Indus get the immense quantities of earth which builds their deltas, spreads out upon the broad plain and is gradually filling up the bay. The Sanpoo drains the eastern part of the two steep and lofty slopes of the Himalayas and the Kara Korum ranges and then breaks through the highest mountain range in the world. Kuen Lun has a greater average height. The Indus, with its tributary, drains the western slopes of the same mountains. You can think of these snow-clad mountains. (Himalaya means snow-clad.) You can think of countless rivers of ice (glaciers) furrowing the precipitous slopes. Every year

when the sun moves toward the north and shines upon the vast fields of white snow and upon the rivers of ice the snow melts; the ice leaves huge piles of rocks, gravel and sand at the ends of the glaciers (terminal moraines), which the melted ice takes up and hurls down to the river floods below. The swift current grinds up the pebbles in its rocky bed and carries the fine silt down until the slowly flowing river on the plain below drops its burden, which now builds new land or deepens and enriches the soil. The soil is not always richer, however, for in many places there is altogether too much sediment for healthful vegetation. Look at the right slope of the Indus basin; the river with its branches brings down an immense amount of earth, and added to this, the Solyman and Haly mountains pay no small tribute of ground-up rock to the valley below; the result is, this part of the plain is nearly if not quite a desert—dark jungles for wild beasts—and broad expanses of barren sand, not only upon the right but also upon the left slope. There is one thing very wonderful about this plain; a traveler can go from the mouth of the Ganges in a northeasterly direction to the Punjab, and then down the Indus to its mouth without seeing a pebble as large as the end of your finger. The stone mills in the mountains must do their work well.

The upper part of the Indus basin is called the

Punjab or Five Waters, because several tributaries flow in the same general direction and form between them a peninsula-shaped region. The lower part of the Indus basin is called the Sinde. The Godavery, Kistnah, Pennair and Cauvery rivers rise in the western Ghauts, cross the Deccan and flow into the Bay of Bengal.

India, from the base of the Himalayas to Cape Cormorin is, in its horizontal form, an equilateral triangle, 1,900 miles on each side. Walled in by mountains, it may be called one of the regions especially adapted by its structure for a nest-place of civilization. This area is 1,490,000 square miles, larger than the combined areas of Great Britain, France, Spain, Portugal, Germany, Austria, Italy, Denmark, Norway and Sweden; 252,000,000 people live in India.

The long plateau. From the right water-parting of the Indus to the waters of the Archipelago or Ægean sea and the Dardanelles stretches toward the northeast, one unbroken plateau. It is enclosed on the north by the Black, Caspian and Aral depression; on the south by the Mediterranean sea, the valley of the Tigris and Euphrates, the Persian gulf, Gulf of Oman and Arabian sea; on the west it sinks into the Ægean sea to rise again in many beautiful islands, which connect this plateau with another plateau in Europe, that reaches to the Alps. This plateau is 2,500 miles long

and nearly 800 miles broad from the valley of the Amoo Daria to the Arabian Sea. It is surrounded by a rim of mountains. At one place it is connected with the Caucasus mountains by a narrow isthmus of highlands; at another a range of mountains runs along the Mediterranean coast and connects with the plateau and peninsula of Arabia. Although one land mass, it may be divided into the plateau of Iran, the Armenian Highlands and the peninsula of Asia Minor or Anatolia. Iran is divided into Afghanistan, Beloochistan and Persia. With the exception of Asia Minor and the Armenian highlands the greater part of this plateau is a desert. On the slopes of the enclosing rim there are many very fertile spots, as the high mountains in the plateau catch rain enough from the nearly dry atmosphere to make some beautiful oases. The Helmund river, like the Tarim and Humboldt rivers, sinks into a vast marsh. Asia Minor is a great tangle of mountains in which there seems to be no order. The eastern slope bears several fine rivers to the Ægean sea. Here is the ancient Meander, a winding river from which we get the word *meandering*. You will learn much about this slope when you study the very interesting history of Greece. Here is ancient Troy; here Ephesus; over this strait (Hellespont, bridge to Greece,) Leander tried to swim; and here is the Golden Gate (Bosphorus, ox-ford,) that Russia covets so much. Why?

The whole plateau itself constitutes the greater part of the *world* that Alexander the Great conquered. Between the rim of the plateau and the Syrian desert (a part of Arabia) is the famous valley of the Euphrates and Tigris, or valley of Mesopotamia. Here Paradise was located (it is said); here was Babylon, Chaldea and here are the ruins of several ancient cities.

Asia Minor, I have said, is connected with Arabia by a range of low mountains running along the shore of the Mediterranean sea. In all the past of this world, probably, no mountains ever were so full of wonderful history as this range. Not far from the place where this coast range starts from Asia Minor is Tarsus; then follows the land of the ancient Phœnicians, the first commercial nation known in history. Here are the mountains of Lebanon on which grew the famous cedars; but here is a land more wonderful in its history than all the lands in the world. Do you see this little river sixty miles long? This sea so small that I can scarcely mold it on this map, this sea supplies the meandering river with water and this sea receives the river; sea of Galilee, the river Jordan and the Dead Sea! The Jordan valley is a deep ditch or moat, to defend from invaders a little mountainous land, bounded on the west by the Mediterranean; on the south by the Desert of Sin, which the wandering Israelites crossed; on the north there is a little plain, the one weak spot

in this mighty natural fortress. In ancient times there were wandering tribes and nomads whose trade was war. Let a people settle down to farm life and these savage foes to progress would drive out the farmers and destroy their homes. Just over the desert of Syria, in the valley of Mesopotamia, lived in those days the great nation of Assyrians. The Israelites, after they crossed the dreary desert and fought their way up the deep, dark ravine or mountain gorge which led to Jerusalem (for this land is Palestine), could have held their conquered lands but a short time were Palestine not a great natural fortress, surrounded by a deep moat, a sea and a desert. This little patch of land, so small on the map, held a people who had more to do with the civilization of mankind than all the rest of Asia together. I tell you this to show how much the structure of a country has to do with its civilization. The coast range which bears Jerusalem, Bethlehem, Nazareth and Hebron leaves the coast of the Mediterranean and extends southward, forming the small triangular peninsula of Sinai, enclosed on the west by the Suez canal and the Gulf of Suez, and on the east by the Gulf of Akabah, which lies in the same depression as the Dead sea and the river Jordan. The Mediterranean coast range, which includes ancient Phœnicia, Palestine and Sinai, is the northwestern rim of the peninsula and plateau of Arabia. This peninsula is of a quadrangular shape, widen-

ing in the southern part. It is 1,800 miles long with an average width of 600 miles. Taking the river Euphrates as one of its enclosing bodies of water, the isthmus connecting it with Asia Minor between the Gulf of Scanderoon and the upper waters of the Euphrates, is less than 100 miles wide.

Arabia is enclosed by the Suez canal, Red sea, Gulf of Aden, Arabian sea, Persian gulf and the Euphrates. It is described as a rainless, treeless plateau of sand and rocks; still it is said that two-thirds of the land is arable. The southern escarpment or slope of the rim toward the Indian ocean is quite fertile. Here (pointing on molded map) is Mecca and here Mocha. Every one knows what they are noted for. The central portion of Arabia is called the Nejd (highlands). The mountains here catch the rain and there are many fertile oases. Look on the map; not one river is given for all this vast expanse. Arabia has very much in common, in shape and general description with the plateau separated from it by the valley of Mesopotamia and the Persian gulf, the plateau of Iran. Notwithstanding Arabia is so dry and sandy it has a wonderful history in the world's civilization. The science of mathematics had its birth in this land; our figures in arithmetic are called, you know, the Arabic system of notation.

Peninsula of Greece. The Taurus and Anti-Taurus mountains sink into the Ægean sea or Archi-

pelago and mark their track to Greece by many beautiful islands; islands whose names are preserved in myths and history. The sailors of ancient Greece, at the time ocean navigation was in its infancy, when on their way from Europe to the shores of Asia Minor were never out of sight of some lovely island or islet in the Ægean sea. After the Phœnicians had made commerce a great power, Palestine fell, for that country had no good harbors, and its people no commercial spirit. Civilization moved westward along the northern shores of the Mediterranean. Of all the peninsulas of the world the peninsula of Greece has the most remarkable history: It is walled in on the north by the Balkans and the Dinaric Alps, as the Himalayas wall in India and the Alps, Italy; protecting them alike from the cold north winds and the invasions of savage foes and giving from their cold tops an abundance of moisture.

The Balkans and Dinaric Alps cannot be called a range of mountains; they form a great maze of mountains similar to Asia Minor. The northern slope of this mass of mountains is drained by the Danube. These mountains, under the general name of Balkans and Dinaric Alps, fill up and form the broad northern or Balkan portion of the peninsula. They reach from the head of the Adriatic to the Black sea, bounded on the

north, almost its entire extent, by the Danube river; on the west roll the waters of the Adriatic; on the east are the Black and Ægean seas. The Dinaric Alps send a long spur southward down into the Mediterranean, which, with numerous spurs, forms the peninsula of Greece proper.

This lower peninsula is cut nearly in two by a deep fiord-like indentation called the Corinthian gulf. The part thus cut off is called the peninsula of Morea; once it was called Peloponnesus. The range sent southward from the Dinaric Alps has several short spurs; between these spurs are pleasant, fertile valleys. In Morea there is a plateau called Arcadia. In mythology you will read much about this well-wooded table land. To the student of Greek history every mountain, hill, valley and harbor in this sea-girt land recalls some marvelous story. Here is Mount Olympus (pointing), from whose top the god Jupiter, or Zeus, sent down the lightning; here are the Parnassus, Helicon and Cithæron mountains; along this shore is a long, narrow island (Negropont), the ancient Euboea, separated from the main land by a narrow sound. Between this sound and the mainland is the famous pass of Thermopylæ, a few miles south of this pass is the battle ground of Marathon. Here is the city of Athens, the ancient seat of learning. It is named for the Goddess Athene or Minerva. The forest plateau of Arcadia sends out

four spurs to the southeast; between the two longest spurs is the river Eurotas, on the right bank of which was the unwalled city of Sparta—unwalled because it was defended by its brave sons.

This land of Greece may be called the most wonderful and the most interesting country in all the round world. Away back in ancient times, before the days of written history, tales of gods and goddesses, nymphs and satyrs were told. Jupiter thundered from the mountain heights, Neptune plowed the sea, Vulcan had his forges on one of the beautiful islets in the Ægean sea; here Apollo shot his fatal arrows and Hercules, the hero, performed his wonderful feats of strength. Here the blind poet, Homer, sang his interesting stories of the taking of Troy and the wanderings of Ulysses. Then came the true history, more wonderful than the myths. Plato, Socrates, Pericles and Phidias, all names renowned in history, were inhabitants of this land of song, poetry, music and art. The political institutions under which you live had their birth here.

The Peninsula of Italy. Fierce wars drove colonists from Greece to Italy. Æneas with his father, Anchises, came from burning Troy. This peninsula has a history hardly less wonderful than that of Greece. You may have read something of the history of the Roman Empire that once conquered Greece,

Palestine and Egypt. The arched Alps form a mighty wall on the north; a wall that guarded the Roman Empire against its foes for centuries. Over the snowy tops of these mountains came the army of Hannibal with its elephants; over the same heights centuries later came Napoleon with an army that knew not defeat. Cæsar crossed the same mountains as he came from Rome to conquer Helvetia (Switzerland) and Gaul (France). From the southwestern end of the mountain arch a long compact range of mountains runs southeast down into the Mediterranean for 600 miles.

At the southern end the Appenines separate and form two spurs between which is the Gulf of Taranto. The eastern spur forms the heel of a well-defined boot, while the western branch is the instep and toe. The toe is directed toward the island of Sicily. On the Adriatic is a spur to the boot, so that Italy may be called the boot-shaped peninsula. A distinct axis running the entire length of Italy marks the division of the peninsula into two short slopes; the united length of both is nowhere more than 100 miles. The Adriatic or the eastern slope is the shorter. Short streams drain the two slopes; on the west the Tiber and Arno are the largest and most important. On the banks of the Tiber stands Rome; on the Arno, Florence. The lower part of the western slope above and for a short distance below the mouth of the Tiber is very marshy.

Here is Vesuvius, a great volcano looking down upon the beautiful city and bay of Naples.

Between the axis of the northern part of the Appenines and the axis of the Alps is the basin of the Po. The valley of the Po is a level plain of alluvial soil. Once, it is said, the waters of the Adriatic filled this entire valley. The Alps and Appenines contributed the soil to fill up the sea. Like the Ganges, the Po is now constantly building land out into the Adriatic. Venice, the city on the sea, is built upon the marshy coast of this plain. I wish that I could take you all on a trip from Switzerland over the snow-crowned Alps, down into sunny Italy. In Switzerland the climate is cold, the soil rough, rocky and not very fertile; vines cling to mountain sides and grass grows on steep declivities. One day's ride over the Simplon by Napoleon's road and you drop down into a land laughing in the sunshine, sparkling waters, luxuriant vines, bright flowers and lakes so beautiful that they seem more like dreams than reality. The valley of the Po has many groves of mulberry trees, whose leaves feed the silk worms. The mild-eyed, long-horned Roman oxen are used to plow the rich soil brought down the steep and rugged slopes of the Alps and Appenines. Some day, I hope soon, you will learn what a great part this boot-shaped peninsula has had in the history of the world.

Leaving the shores of Italy you must glance at Genoa, the birthplace of the discoverer of America. Here, on a little island called Elba, south of the mouth of the Arno, the great conqueror of Europe, Napoleon, was confined. Just east from Elba is his birthplace, the island of Corsica; south of Corsica and separated from it by a narrow strait the larger island of Sardinia; the two islands seem to form one mountain range. Between the western coast of Italy and the last peninsula of the famous six is a wide stretch of waters curving up to the base of the Alps and the mouth of the Rhone.

Peninsula of Spain or the Iberian Peninsula As the Himalayas guard India, the Balkan and Dinaric Alps, Greece, and the Alps, Italy, so do the Pyrenees lift their lofty walls across the broad isthmus between the Mediterranean and the Bay of Biscay, stretching away to the Atlantic in the Cantabrian range. The peninsula of Spain is enclosed by the Pyrenees, Mediterranean, Atlantic and the Bay of Biscay. Its shape is an irregular square, each side 500 miles in length, the whole square containing 228,000 square miles. From the middle of the southern side there is a projection of land which nearly meets a corresponding projection from Africa. Between the two projections are the straits of Gibraltar—the Pillars of Hercules—

as the stone walls of the straits were called by the ancients; this to them was the end of the world. The famous Rock of Gibraltar forms the point or promontory of the projection from Spain. This peninsula is filled with mountain ranges extending east and west, with narrow valleys between them. There is a short slope to the Mediterranean and a long slope to the Atlantic, with one notable exception. The Ebro basin, the largest in Spain, slopes to the Mediterranean. The long slope is principally composed of the Douro, Tagus, Guadiana and Guadalquivir. There is a striking resemblance between the drainage of the Deccan or peninsula of India and the drainage of Spain. The Ebro corresponds to the Nerbudda, and the other rivers of Spain flowing westward correspond to the rivers of the Deccan flowing eastward. Spain is a plateau like the Deccan; a large part of it is dry table land. The basin of the Guadalquivir (Andalusia) is very fertile and very beautiful.

The history of the Spanish peninsula is not so important as that of Greece or Italy, still it has played no small part in the world's history. The Moors crossed from Africa and held this country, especially the southern part of it, in subjection for many years.

NOTE.—It is proposed to make a course of history embracing the ancient history and some of the modern history of these great *nest-places of civilization.* This course is to run parallel with the course in geography.

Washington Irving has told us much about Spain and the Moors.

Review the Malay peninsula, India, plateau of Iran, Armenian Highlands and Asia Minor, valley of Mesopotamia, Palestine, Arabia, Greece, Italy and Spain. Compare. Find resemblances. Which two countries are the most alike? In which two countries are there the greatest differences? Which was the best adapted to ancient civilization? Why? Which is the best adapted to modern civilization? Why?

Review the general description of Eurasia, slopes, highlands, plains, river basins and peninsulas.

Draw and describe Asia by itself and then draw and describe Europe. Compare the two grand divisions. At this stage of the work it may be well to put off the study of climate, soil, vegetation, animals, races of men and political divisions until the structure of Africa and Australia has been learned. If, however, the teacher wishes to teach these subjects here, the same general plan can be followed as that given in the notes on North and South America.

NOTE.—To make assurance doubly sure, it is explained that this somewhat extended description of the general features of Eurasia is given to *aid the teacher* in forming the concept corresponding to this, the largest continent in the minds of his pupils. The bits of history are presented to arouse an interest in the study of structure. *Never tell pupils that which they can tell you, and demand that they tell you all that you tell them. Molding, drawing, reading, writing should be constantly used to aid in the concept building.*

STRUCTURE OF AFRICA.

The structure of the continent of Africa differs very much from the structure of all the other continents, with the one exception, Australia. It may be called a great unorganized mass of land. It is not divided into slopes nor great river basins. It is a vast plateau, 5,000 miles long and 4,600 miles broad, containing nearly 12,000,000 square miles, surrounded by 16,000 miles of coast line. It is very slightly broken by projections and indentations.

The continent as a mass of land may be divided into Northern Africa and Southern Africa. The northern part is the great mass extending east and west, a distance of 4,600 miles, the southern part extends from the northern part southward, ending in the Cape of Good Hope. The great plateau continent is walled in by a rim of mountain ranges.

Beginning on the coast of the Mediterranean, just west of the Suez Canal, we find a low range of mountains sloping toward the Red Sea. This range expands and increases in height in the plateau of Abyssinia, the highest land in Africa. The same mountain mass (Plateau of Abyssinia) extends southward under other names, and culminates in the high peaks of Kenia and Kilimanjaro.

From this mountain mass a lower plateau extends out into the Indian Ocean, just south of Arabia, in a triangular-shaped peninsula. South from Kenia and Kilimanjaro the mountain ranges run along the coast to the Cape of Good Hope. These ranges have many names, but

they may be looked upon as one great range or mountain mass, sloping to the Indian Ocean, and enclosing a series of plateaus. The slope is generally very short. The Abyssinian plateau drops abruptly 7,000 feet to the coast line of the Red Sea. The inner or western slope sends its waters for 3,000 miles to the Nile. One part of the mountain mass holds the great lakes, Victoria N'yanza, Albert N'yanza, and Tanganyika, the reservoirs of the most wonderful river in the world. South of the Nile basin, a plateau formed of Njesa mountains, holds Lake Nyassa, which sends its waters southward to the Zambesi, that breaks through the mountains on its way to the Indian Ocean. The Limpopo basin joins the Zambesi basin on the north.

In and south of the Limpopo basin is a very interesting region in modern history. The lower part of the short slope is a comparatively level plain, the home of the Zulus. The Continental axis, or line of highest points, runs over this continuous mountain mass from the Mediterranean to the Cape of Good Hope, but there is no long slope reaching westward to the Atlantic, as in the other continents. Most of the land in Eastern Africa is drained into the Mediterranean and the Indian Ocean by the Nile, the Zambesi, and the Limpopo.

On the western coast a range or ranges of mountains may be traced from the Cape of Good Hope northward to the Mediterranean. The mountains are lower than those on the eastern coast. At the Bight of Benin the mountains turn directly to the west and here rise to their greatest heights. Here is the Gold Coast, the southern slope of

the Kong Mountains. From this coast millions of poor, ignorant and helpless men and women have been carried off into slavery to toil for more highly civilized beings. Along the western edge of the Desert of Sahara there are no high mountains, at least there are none upon the maps.

Through the mountains from the Cape of Good Hope to the western extremity of the Kong Mountains, the Orange, the now famous Congo, the Ogewai, and the Niger rivers cut their way to the Atlantic. The mountains of Barbary slope to the Mediterranean, extending from the Atlantic to the Gulf of Cabes. Here we find an inset or indentation 600 miles long between the mountains of Barbary and the plateau of Barca. A low line of mountains extends along the coast nearly to the Nile.

Thus we see Africa is a great plateau walled in by mountains. The slopes and river basin that can be described with some degree of clearness are:

1. The Nile Basin.
2. The Barbary Slope
3. The Gold Coast.
4. The short eastern slope of Southern Africa.

The portions of Africa which can be described, in a very indefinite way only, are:

1. Desert of Sahara.
2. The Soudan region.
3. The Great African Plateau.
4. The Kalahari Desert.

It may be well to mold and describe the larger and partially explored regions first.

The Desert of Sahara.—This, the largest desert in the world, is bounded on the west, north and east by the Atlantic Coast line, the axis of the Barbary Mountains, the coast line of the Mediterranean, and the line which bounds the narrow strip of alluvial soil on the Nile; the southern boundary, to present knowledge, is very indefinite; it is marked approximately, by an irregular line extending eastward from the mouth of the Senegal across the continent to the Nile basin.

Any attempt at more than a very general description of the great desert would be useless. It would be a very great mistake to imagine it a plain, for it is filled with mountains, mountains of rock and mountains of sand. It would be a still further mistake to call Sahara a barren waste, as there are many fertile oases, together with many mountain ranges, which lift their crests high enough to catch the moisture and to make the valleys below quite fertile. The Plateau of Air and Asben, nearly in the center of the Desert, is said to be excellent land for cultivation.

Sahara is a riverless region. In the northeastern portion is the Wady Draa, over whose bed water runs from the southern slope of the Barbary Mountains for a part of the year. South of these mountains are the great sand dunes, or shifting piles of sand, heaped up like huge snow drifts by the wind. Probably the most desolate portion of the Desert is in the eastern part south of the oases of Anjilah and Siwah. This is called the Libyan Desert; great mounds of drifting, shifting sand, high as

high hills, are piled or scattered at the mercy of the winds; an ocean of sand billows that drift past the pyramids, over the wheat-fields of Egypt.

There are three depressions in Sahara which are lower than the ocean level. One is northwest from the great bend of the Niger, 150 miles from Timbuctoo; it is said to be filled with rock salt. Another depression is the oasis of Twat, which is the valley of a wady basin sloping from the Barbary Mountains. The largest depression lies south of the Mediterranean coast, between the Nile and the Gulf of Sidra. This depression is 500 miles in length and breadth, and from 150 to 200 feet below the level of the Mediterranean. A canal seventy-five miles long from the Gulf of Sidra would change this depression into a great inland sea. Many parts of the Desert are now irrigated by artesian wells. (Tell stories of caravans, wandering tribes of Arabs, and the "Ships of the desert," camels.)

Soudan and the great African Plateau.—Rising from the southern edge of the Desert is a higher plateau, which is sometimes called the Great African Plateau. This land is watered by the aid of heights and favorable moist winds. Trees are found on the edges of the higher plateau, but the land is generally marked upon the maps as a steppe or prairie region. The northern slope of the Kong mountains is well wooded and very fertile.

South of the area of grassy plains is a great tropical forest land, a vast expanse extending almost across the

continent. It embraces the entire basin of the Congo, and the upper part of the Nile basin. Here Livingstone, Stanley and Baker made their important explorations, the most important result of all these being the discovery of the source of the Nile.

South of the forest region is a vast steppe, part of which is very fertile; and south of the steppe is the Kalahara Desert, like the Sahara, a great sandy plain. Still further south we find the basin of the Orange River, the Karoo Desert, and the mountains on the coast. Nothing like an accurate map has ever been made of this vast region which stretches between the Mediterranean and the Cape of Good Hope, 4,500 miles. It is well to accept certain well-known facts. The time which children sometimes spend in learning the imaginary boundaries of so-called political divisions, might as profitably be spent in bounding the mountains in the moon.

The Nile Basin.—In all the earth's structure there is nothing more wonderful than this wonderful river basin. I have told you about the right slope of this basin and 3,000 miles of the continental axis which forms its water parting. The left slope, if we may trust the maps, gives the Nile very little water; there are only three small tributaries on this slope, the largest of which is the Djur, which enters the Nile just opposite the southern extremity of the Abyssinian Plateau.

In the great mountain mass on the eastern side of the central forest region, are three great lakes, Victoria

N'yanza, Albert N'yanza, and the Tanganyika, the immense reservoirs of the Nile. From this same mountain mass flow two tributaries into the Nile, one of which is the Sobat; these two rivers, together with lakes, furnish the main current of the Nile, which flows the year round. But the torrents that make the floods, and carry the rich stores of ground-up rock, come from the lofty Abyssinian mountains down through the deep gorges and ravines, which are furrowed in the abrupt slopes of the plateau. Two great tributaries, the Blue Nile and the Atbara or Black River, in the rainy season, pour immense quantities of water into the main river.

From the mouth of Atbara clear to the Mediterranean, for 1,200 miles, the Nile has not a single tributary, nor does its basin receive a drop of rain; indeed it has no basin for this long distance. It dashes over five cataracts, and plows its way through land, which without it would be a part of that desert of deserts, the barren and desolate Libyan sand ocean. The hot sun of the tropics robs it of its floods, the thirsty hot sand drinks it—but on it goes, bearing its precious burden of rich soil down to the valley below, where it changes a desert into the most fruitful land in the world. Had this wonderful river turned into the Red Sea or been lost in the desert, instead of pyramids, temples, ruins of ancient cities, and a marvelous history, the record of Egypt would have been that of the Libyan Desert—and nothing more. Protected by deserts, supported by a green strip of rich earth, the gift of the Nile, the grandest empire of ancient times rose,

flourished through many centuries—and to day, though dead, yet speaketh in the wonders of antiquity.

We have India, Palestine, Greece, Italy and Spain, the nest places of human civilization, but this little Egypt, dependent upon the waters of one river for its growth and development, seems to be the most wonderful of them all. (Describe the pyramids and temples of Egypt.)

The Barbary Slope.—From the Atlantic to the long indentation of the Mediterranean, a distance of more than 1,300 miles, there is a mass of mountains and plateaus, which slope toward the latter (the Mediterranean) on the north, and the Desert of Sahara on the south. The principal range is the Atlas, named after the god who, according to the ancients, bore the world upon his shoulders.

The northern slope has three distinct divisions; the lower part next to the sea is called the Tell, and consists of cultivable land; the middle part is steppe land, good for grazing; and the upper or mountainous part is dry and partially barren, containing many brackish lakes or sebkhas. The southern slope sinks into the countless sand dunes of the Desert. It rains on the northern slope nearly five months in the year (October to February), while on the southern slope it rains only one month. The date palm grows here close to the borders of the Sahara. On the coast of the Mediterranean, southwest from Sicily, was once the ancient city of Carthage.

The Gold Coast.—South of the Barbary mountain mass, sloping to the Gulf of Guinea, is another similar mountain mass, of nearly the same length and breadth. The principal range is the Kong Mountains. Along the coast, like the Tell, is a narrow strip of level and very fertile land, which broadens at the delta of the Niger. North of the level plain is a rich and very densely wooded country, mountainous and inhabited by fierce tribes of black men. Here dwell the Ashantees and the cruel savages of Dahomey. For centuries civilized nations have tried to soften the savage hearts of these fierce barbarians *by stealing the inhabitants for slaves.*

The Short Eastern Slope.—From the mouth of the Zambesi to the Cape of Good Hope is a short abrupt slope, embracing on its lower edge a narrow plain. This plain is very fertile, and the steeper slopes above furnish excellent pasturage. The Dutch colonized this slope many years ago, and you will notice that most of the names of mountains are Dutch. The English, who claim the right to conquer all the weaker portions of the earth, tried to master this slope. They conquered the Zulus, but the sturdy Dutchmen held their ground.

There is hardly a mile of definite boundaries of political divisions accurately known outside of the Barbary States, with the exception, it may be, of Sierra Leone and Liberia. After the structure of all the continents has been learned, it may be well to study the climate, soil, vegetation, animals and races of men.

AUSTRALASIA.

We have now, for our last description, a wonderful world of islands; a vast submerged continent; or it may be a continent rising from the Pacific Ocean. You remember the long mountain range, partially under the ocean, that extends from Kamchatka—all along the eastern coast of Asia, Kurile, Japan, Loo Choo, and Formosa islands, ending in the Philippine Islands. The coast of Asia turns to the west opposite these islands—but the islands themselves continue, stretching away for thousands of miles to the south and east, girt by the green waters of the peaceful ocean. The eastern extremity of this greatest of all archipelagos, is the long narrow island of Sumatra, which, with Java, and other smaller islands, extends to the east. From the northeastern end of Sumatra this island world stretches away to the east for nearly 9,000 miles. From the Sandwich or Hawaiian Islands southwest to the little Emerald Island, may be reckoned the breadth of Australasia, as this great mass of islands is now called.

Australasia covers a surface much larger than all of Eurasia. The western part of Australasia contains by far the largest islands. Sumatra, Java, Borneo, (three and a half times larger than Great Britain); Celebes, which looks like some gigantic insect; the Molucas or Spice Islands, and New Guinea, are the principal ones, if we except Australia, the largest of them all. It is an open question whether to regard Australia as a continent or an island.

It is not worth your time to learn the names of all the groups of islands in this mighty Archipelago, you can learn the names of the constellations easier, but when you read of travels or explorations here you can find on the map the places visited. Here are Fiji Islands, Cook Islands, named after the famous explorer, Society Islands, and Samoa Islands; you have read perhaps that Germany is laying claim to the latter group. New Zealand, the largest island in the southern part of Australasia, is made up of several islands separated by narrow straits; it is as large as Italy and Sicily, and is in shape very much like Italy; the toe of the boot, however, points toward the northwest. The Sandwich Islands are best known to us, as they are nearest our continent. Some day you may read of the wonderful things in these islands, of the coral formation, of the atolls, the volcanoes, the animals, the vegetation, and the human beings that live here.

AUSTRALIA.

Australia is the largest island and the smallest continent in the world; its area is 2,983,200 square miles. It has 8,000 miles of coast line, is 2,500 miles in length from east to west, and 1,950 miles in breadth from north to south (mold as you describe). Australia differs very much from all other continents. It is thought by geologists to be a mass of islands which have been joined by lowlands that have risen out of the ocean during a late geological period. Where once, it is said, was a great number of islands like other portions of Australasia, is now one solid

body of land. If the level of the ocean were raised 500 feet the lowlands would be flooded, and the continent would return to its supposed former state, an archipelago.

Australia may be described generally as a vast expanse of lowlands, enclosed by a rim of hills and mountains, with highlands here and there rising from the lower levels. The conventional shape of this continent is an oblong. The coast line is very regular, having only two great indentations, the deep Gulf of Carpentaria and the opposite bay, the Australian Bight: Spencer Gulf, Encounter Bay, and Cambridge Gulf (pointing) are smaller indentations. The Gulf of Carpentaria lies between two large land projections, the long, narrow, pointed peninsula of York, and the broad land mass of Arnheim. Off the eastern coast of Australia, from York Cape, the extremity of York Peninsula, there extends southward for 1,200 miles, a remarkable coral formation, called the Great Barrier Reef. It has only one safe entrance for ships. This reef is from 20 to 150 miles from the main land; the waves of the Pacific break against it, forming a long line of white foam.

The eastern side of Australia, next the ocean, is a mountain mass extending the entire length of the coast, from Torrens Strait to Bass Strait, 1,700 miles, from which point the mountain ranges turn to the west. This mountain mass is composed of several parallel ranges which are drained on the ocean side by short rivers, the longest being not more than 200 miles. These rivers cut

their way to the ocean through deep gorges seaming the flanks of the mountain slopes.

Australia contains only one great river basin, the basin of the Murray, with its tributary basins of the Darling, Lachlan, and Murrumbidgee. The left slope of the Darling and Murray is the long inward slope of the eastern mountain mass. This basin seems to be the only extensive *organization for life* in the lowland continent. The upper part of the basin is fertile; grassy cultivable lands abound, but the lower part is a dreary waste. The long river flows through a desert, and sinks into an immense marsh before it reaches the ocean. West of the Murray basin is a vast lake region. Lakes Gardner, Torrens and Eyre are great bodies of brackish water surrounded by desolate, rocky, barren plains. The northern, western and southern edges of the continent contain few elevations that may be called mountains. Many rivers flow down the short low slopes. In the northwest there is some fertile land; with this exception it is believed by explorers that the western half of Australia is little less than a barren wilderness.

As late as 1860 the government of Australia offered $50,000 to any one who would travel the entire breadth of the continent from north to south, west of the Murray basin. In 1862 a man by the name of Stuart succeeded in doing this after a terrible struggle through the almost impenetrable wilderness. Thousands of square miles are covered by dense jungles or bushes; the principal shrub is a kind of *Eucalyptus*, which grows eight or

ten feet high, and covers the ground in matted tangled masses. This shrub, which sends its roots down into the soil for long distances in search of moisture, will grow and flourish where another plant would perish. The Alfalfa, (a sort of clover) is largely cultivated in the sandy regions of our own continent for the same reason. Around Lake Eyre grows a hard, coarse, spiry grass in clumps or tussocks, "covering the arid plains for hundreds of miles." This grass is so hard and sharp that it wounds the feet of horses. (See Stanford's Compendium, Australasia, page 21.)

The plants and animals and aboriginal races of men differ very much from those of the rest of the world. The leaves of the trees hang down and furnish little or no shade; some trees are practically leafless; one animal has a duck's bill and four legs; and finally, the Bushmen are the lowest order of savages known. Once England sent many of its criminals here, (to Botany Bay) but after the discovery of gold (1851) the inhabitable portions of the continent were very rapidly colonized. A large island (Tasmania) lies south of Bass Strait, which separates it from the continent. (Read Cook's Voyages.)

The Earth as a Sphere.—If the work laid down in this course of study has been thoroughly done, pupils are now prepared to form a mental picture of the whole earth as one spherical body. A globe may be profitably used from the beginning of the work, but if the well-known laws of synthesis are true, the mind cannot be prepared for anything like a clear concept of the whole earth until the

parts of which the whole consists are mental products. These products are the concepts of continents, which are to be arranged and related in the mind in correspondence to the reality.

For the first step a good device is to mold in putty the different continents and islands upon a small paper globe (costing 20 cts.). While molding the continents in this way there should be a thorough review of all previous work. The relation of the continents to the oceans should be carefully studied, and the whole picture fixed in the mind.

Questions.—What land slopes to the Pacific Ocean? To the Indian Ocean? To the Mediterranean Sea? To what oceans do the short continental slopes incline? Nearest to what oceans do you find the continental axes? To what oceans do the long slopes incline? What land slopes toward the Atlantic Ocean? The Arctic Ocean? What points in the Continental axes are farthest from the oceans? What points are nearest the oceans? Into what oceans do the peninsulas project? What highlands protect the contitinents from being worn away by the waves of the ocean? What coast lines have no such protection? Why? What peninsulas have a mountainous structure? What peninsulas are lowlands? What islands seem to have been parts of continents? From what highlands were they broken off? What islands partially enclose seas? What seas, bays and gulfs lie between peninsulas? What peninsulas extend in a southerly direction? What peninsulas extend

in a northerly direction? What in a westerly direction? Easterly?

Relation of Drainage to the Oceans.—What ocean receives the most water from the land? What the least? Into what oceans do the longest rivers flow? The shortest? Name the longest and shortest rivers received by the Pacific Ocean. The Atlantic Ocean. The Arctic Ocean. The Indian Ocean. What areas of continents are not drained into the ocean? What rivers flow directly into the ocean? What rivers flow into seas, gulfs and bays? What is the largest river in the world, whose waters are not received by the ocean? The next largest?

Areas, Breadth and Length of Oceans.—What ocean has the largest area? The next largest area? At what points are the continents joined? At what points do they approach each other the nearest? What distance on the ocean *must* you travel in going from Cape Horn to the Cape of Good Hope? What ocean is the widest, (East and West)? What ocean has the most indentations—seas, bays and gulfs? What ocean the fewest? What indentation extends the farthest into the land? Name all the indentations of the Pacific in order, from Cape Horn to the Malay Peninsula. Of the Indian Ocean. Name the indentations of the Atlantic from Cape Horn to the Cape of Good Hope. Of the Arctic Ocean from Bering Strait eastward to Bering again. What indentations extend in a northerly direction into the land? In a southerly direc-

tion? In an easterly direction? Westerly? What ocean has the longest coast line? The shortest? What ocean has the most regular coast line? The most irregular? What ocean has the most islands? The largest islands? Put this table on the blackboard.

AREAS OF CONTINENTS COMPARED WITH LENGTHS OF COAST LINES.*

	AREA.		LENGTH OF COAST LINE.
Asia	16,216,600	sq. miles	19,800 m.
Africa	11,314,300	" "	16,200 "
North America	8,261,900	" "	27,700 "
South America	6,887,500	" "	15,500 "
Europe	3,565,200	" "	19,800 "
Australia	2,948,300	" "	8,760 "

Problems.—What is the combined area of all the continents? What is the combined length of coast line of all the continents? What is the area of Eurasia? What is the length of coast line of Eurasia? Which continent has the longest coast line? Which the shortest? What is the difference in length between the longest and the shortest? What is the proportion of square miles to a mile of coast line in each continent? Which continent has the greatest area to a mile of coast line? Which the smallest? How many square miles of land are there to a mile of coast line in the world? There are 196,900,143,000 square miles of surface on the globe: what is the difference between the land surface, and the ocean surface? What is the proportion in squaremiles of ocean surface to continental surface?

* Taken from Guyot's Physical Geography, page 23. It will be seen that estimates of areas differ according to authorities.

General Review and Comparison of Continents.*— Name, in order, all the mountain systems over which the continental axes pass from Cape Horn to Cape Finisterre. Name the mountain ranges over which the continental axes pass from Cape Horn to Cape Finisterre. Name the mountain ranges over which the continental axis of Africa passes from near the Isthmus of Suez to the Cape of Good Hope. By what mountain mass is the continental axis of Africa connected with the continental axis of Asia? Name five of the highest elevations over which the continental axes pass. Five of the lowest elevations. Describe the primary highland masses of each continent. Where in each continent are the primary highlands the widest? Where the narrowest? Where is the widest highland mass in all the continents? Where do the primary highlands consist of a single range? What primary highlands are enclosed by two ranges? Name the ranges that enclose each primary system? Name the principal mountain ranges in the primary highlands that run in nearly parallel directions with the continental axes. Which of these ranges are the highest?† Name the plateaus, which form parts of the primary mountain systems. Give them in order from Cape Horn to Cape Finisterre; from the Isthmus of Suez to the Cape of Good Hope.

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*Anything like the mere memorizing of names would defeat the whole plan. These questions are to assist in the clearness and growth of the mental picture. Have pupils answer without maps if possible. If there are indications of word memorizing, change the questions so as to demand the presence of the pictures in consciousness.

†The heights of a few of the most lofty peaks in each primary mountain system might be put upon the blackboard for reference and comparison.

By what mountain ranges is each plateau enclosed? Which plateau has the greatest area? The second greatest? Which of these plateaus are in the long slopes? Which in the short slopes? What are the principal river basins in these plateaus? What river basins are entirely included in them? What great rivers rise in them? By what mountain ranges is the great plateau continent (Africa) enclosed. What primary mountain sytems have no large plateaus? In what direction do the different mountain systems extend? What systems extend North and South? East and West? What relation has the direction in which the primary mountain systems extend, to the general direction in which the continents extend?

Review of Long Slopes.—Bound the long slope of South America, of North America, of Eurasia, of Asia, of Europe. Name all the parts of primary highlands that are wholly within these slopes. Give them in order from Cape Horn to Cape Finisterre. Name mountain ranges and pleateaus on the long slopes, in the same order. Name the secondary land masses on these slopes or elevated land masses, in which the mountain masses are separated from mountains of the primary land masses by broad plains. What long slope has no secondary land mass? What long slopes have two secondary land masses? Name the upper parts or mountain ranges in these secondary land masses. Name in order as above, the projections, of the long slopes.

Drainage of Long Slopes.—Name all the river

basins on the long slopes, (except those which are wholly contained in the secondary land masses,) from Cape Horn to Cape Finisterre. Name all the rivers which flow the entire length of one of the long slopes. Which of these rivers do not have their sources on the lines of the continental axes? Name all the rivers whose general course is at right angles with the continental axes. Name all the rivers whose courses are in the same general direction as the continental axes. What very long river does not drain one of these long and broad slopes? Where are parts of these long slopes very short?

Plains on the Long Slope.—Name the plains on the long slopes from Cape Finisterre to Cape Horn. How many plains are there on the long slopes? Which of these plains is the largest? Describe the plain of South America, of North America, of Eurasia. Parts of what river basins form these plains? How high must the ocean rise in order to flood these plains? How would the continents look if the ocean should rise 1,000 feet? What rivers in the long slopes flow toward the continental axes? What river basins on these slopes are not drained into the ocean? Enclosed basins. Locate Steppes, Selvas, prairies, llanos, pampas, tundra, Valdai Hills, Ural Mountains, Guiana Highlands, Brazilian Highlands; basin of the Black, Caspian and Ural Seas. Bound the Danube river basin.

Compare Amazon, Mississippi, Lena and Volga river basins.

Review of Short Slopes.—Name the mountains that form the upper parts of the short slopes from Cape Horn to Cape Finisterre. Name all the plateaus in the primary highlands of these slopes. Do the greatest mountain masses belong to a long slope or a short slope? In what continents are these slopes the shortest? The longest? Name all the peninsulas on this slope. Of what mountain ranges and plateaus does each peninsula consist? What peninsula is on both slopes, long and short? What peninsulas contain plateaus? What peninsulas are made up of several mountain ranges? What peninsula consists principally of one range? What peninsulas are enclosed, on one side, by very high mountain ranges?

Drainage of Short Slopes.—Name all the river basins on the short slopes from Cape Horn to Cape Finisterre. On what short slope are the longest rivers? The shortest? What river basins contain plains formed by alluvial deposits?

Parts of what river basins are in the primary highlands? What rivers on these slopes do not rise in the primary highlands? Which way does the land slope in the peninsula of Spain? In the Deccan? What peninsula is comparatively riverless?

What slope does the short eastern slope of Africa resemble? What other river basin does the basin of the Nile resemble?

Review of all the Continents.—Locate the Rocky

Mountains, Andes, Himalayas, Kuen Lun, Alps, Pyrenees, Cantabrian.

Locate Brazilian Mountains, Appalachian, Guiana, Scandinavian, Ural, Kong, Atlas, Blue Mountains.

Locate plateaus of Thibet, Gobi, Great Basin of N. A. Iran, plateau of Central Europe, Kalahari.

Name all the principal rivers which flow to the west, north, south, east.

Locate Zambesi, Congo, Yukon, Columbia, Amur, Danube.

What river basins have large alluvial plains in these valleys?

Locate Hoang Ho, Yang-tse Kiang, Po, Orinoco.

What river basins have their longer courses in primary highlands?

By what rivers is the Brazilian land mass drained? The Guiana? Appalachian? Deccan? Spain?

Locate the great lakes; of what rivers are they the reservoirs?

Locate Madagascar, Japan Islands, Great Britain, West Indies.

Describe Australia. Compare its eastern slope with other short slopes. Which short slope does it most resemble? Compare the Darling river basin with the basin of the San Francisco.

Have pupils mold and draw each continent and describe as they work.

Mathematical Geography.—Parallel with the above

review, lessons should be given in elements of mathematical geography.

Teachers should keep steadily in mind the direct practical purpose of teaching in this stage of the course the relations and influence of the sun upon the earth. The purpose of this is a good knowledge of the distribution of heat and moisture, and of the modifications brought about by different degrees of atmospheric pressure. These are the essential factors in the study of climate.

Climate determines the use of the structure, and structure in a marked degree modifies climate. Both seem to be the two halves of a great whole, which nourish and support life, plant and animal, and at the same time determine the forms and modes of life. There are many very serious difficulties in the way of a clear understanding, on the part of children; of the real relations of the sun to the earth. Long experience in attempting to teach the rotation of the earth and its revolution around the sun has clearly proved that, although pupils may seem to understand the relations, which must be taught to them by apparatus, they gain a very confused and inadequate notion of the whole matter. When we think how many centuries very wise men, who had the same phenomena which surrounds us to observe, were in finding out that which we now know to be true, some light may be thrown upon the difficulties which confront the conscientious teacher at every step. The vast difference between the *apparent* and the *real* causes puzzles the children, as it

puzzled thoughtful students for ages before the truth was discovered.

Long, careful investigations should be made in the phenomena that appeal directly to the senses before any attempt is made to teach the real causes of the earth's motions and its relations to the sun. Among the many subjects for investigation are the rising and setting of the sun, moon and stars, the stars that are always above the horizon, the yearly changes in the position of the sun, causes and effects of heat, slanting rays of the sun, changes of the seasons, length of days, months and years, apparent causes of long and short days, the uses of the thermometer and barometer. This work should be a part of the course from the beginning, but if the necessary results have not prepared the class for the next step, there is no way but to begin at the most elementary phases of the investigation. These and similar questions may be may be used to test the pupils' knowledge:

When does the sun rise? When does it set? Through what does the sun appear to move? Where is the sun when it is half way between rising and setting?* Is it always in the same place at noon? How do you know? What is the place called right over our heads? Is the sun ever there? In what direction from the zenith is it

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Books for Teachers.—Teachers should make a thorough study of mathematical geography before they attempt to teach it. The following books are recommended: Astronomical Geography, Jackson, D. C. Heath & Co., a small book of 73 pages, presenting the whole subject in a clear and compact form. Huxley's Physiography, Appleton, pages 317-377, inclusive, an excellent exposition of the subject. Johnston's Physical Geography, Stanford, London, pages 101-122, inclusive.

at noon? Is it always the same distance from zenith at noon? How can you tell? Measure the slant of rays. This can be done by marking the slant on different days at precisely the same time. When is your shadow, in the sunlight, the longest? When the shortest? When is it longest at noon? When the shortest? If the sun were in the zenith, how long would your shadow be? What time in the year is the sun at noon the farthest from the zenith? When is it nearest? Does the sun always rise in the same place?

You say that the sun rises in the east; does it rise exactly east of you? When does it rise a little north of east? When south of east? When exactly east? Let pupils have time to investigate. If the sun rises a little north of east some days, where does it set on the same days? The sun seems to move in what kind of a line over our heads? Draw the arc of the circle in which the sun seems to move? If the sun moves in half of a circle over our heads in the day time, what does it do at night? What is the place called under our feet directly opposite the zenith? Does the sun pass through another arc of a circle at night? What are the two arcs put together? Is the path of the sun over our heads always just half a circle? Why? Why not? What is the place called where the sun rises and sets? How long does it take for the sun to go from that part of the horizon where it rises to that part of the horizon where it sets? What is the time called when the sun is making its arc from one part of the horizon to the other? Perhaps the sun moves faster on some days

than others; is that possible? Perhaps it has farther to go on the longest days; is that possible. At what time in the year does the sun's rays at noon have the greatest slant? At what time in the year are the sun's rays the nearest to a vertical line? Are the sun's rays ever vertical where you live? If you should travel far enough toward the south, do you think you would come to a place where the sun's rays are vertical at noon? Where would the sun be at noon? If, after finding the place where the sun's rays are vertical at noon, you should travel farther south, which way would the sun's rays slant then? If you should travel straight north, and every day at noon measure the slant of the sun's rays, what would you find?

There is a place in the northern part of the Scandinavian Peninsula where travelers go to see the midnight sun; the sun rises in the southeast like a great ball of fire, and appears to move in a very small arc of a circle toward the western horizon; very soon it sinks down under the horizon. How can you explain this? There are places on the earth where the sun does not rise for six months, and when it does rise it does not set for six months. Does it take a year to go around in the great circle, or does it go around in a circle every twenty-four hours as it does with us?

Where does the moon rise? Where does it set? How long does it take to go from the eastern to the western horizon? Where do the stars rise? Does the sun always go in the same path through the heavens? How often does it change its path? Every day? What is the difference be-

tween the slant of the sun's rays at noon when it is farthest south and when it is farthest north? Draw on the board the difference in angles. Explain the apparent spiral movement of the sun. What day do the sun's rays at noon slant the most? About the 21st of December. What day do the sun's rays at noon slant the least? About the 21st of June. What days is the slant of the sun's rays half way between the greatest slant and the least slant? What is the length of the day when the sun's rays at noon slant the most? When they slant the least? When the slant at noon is half way between the greatest slant and the least slant? How do you account for these changes? What two days in the year have the same length?

Proofs that the Earth is a Sphere or Spheroid.— In all this teaching the *very great* value of elementary lessons in form will be fully appreciated. Give pupils a sketch of the ancient beliefs, and the discoveries in regard to the shape of the earth. The subject presents excellent opportunities to train the insight and reason of pupils. Tell pupils just as little as possible; lead them to question the validity of the proofs very closely; very profitable discussions may be had in this direction.

Principal Proofs.—*Objects moving from and towards you on a level surface, and moving from and towards other objects.*

a. The tops of ships (masts and sails) are seen first when coming toward you.

b. The tops of masts are last seen when sailing from you; they seem to sink into the water.

c. Sailors see heights (tops of mountains and hills) first when they approach the land. Would these facts be possible on a flat surface? How would ships disappear? The surface of the earth might be curved and yet the earth not be a sphere. Would not there be the same effect upon a cylinder or upon an egg-shaped body? What would you be obliged to prove before these facts could be taken as final proof that the earth is a sphere?

2. *Horizon.* What is a circle? What is a plane of a circle? What is the horizon? Do the sky and the earth really meet? How can you prove that they do not meet? Where are you in the horizon? If you change your place, what effect has it upon the horizon? How can you make the horizon larger? How smaller? If you were to go as far from the earth as we are from the moon, how would the earth look? If the earth were flat, where would the horizon be? If the earth were ovoid in shape, what would be the shape of the horizon? What is an ellipse? Is it true that the horizon in all parts of the earth is a circle? How do you know?

3. *Shadow of the Earth on the Moon.*—What is an eclipse of the moon? What makes the moon give light? How can you prove it? Why is there not a full moon all the time? What is the shape of the earth's shadow upon the moon? What form of a shadow does a plane bounded by a circle cast? Then how does a circular shadow cast by the earth prove that the earth is a sphere?

4. *Circumnavigation of the Earth.*—Tell pupils of the voyage of Magellan (in 1520) and others, who early sailed around the world. Is the circumnavigation of the earth conclusive proof that it is a sphere? Why? Why not? If the earth were a cylinder or an ovoid, could it be circumnavigated?

5. *Other Proofs.* In digging canals engineers make allowances for the curvature of the earth. Weights of matter are nearly the same on all parts of the earth. If the earth were not a sphere, weights would differ on different parts of the earth's surface. Explain. A good opportunity for lessons on gravitation.

Give all the proofs that the earth is a sphere. What is the most conclusive proof? Is any *one* proof conclusive? Tell pupils about the flattening at the poles. Describe the popular theory of the creation of the world and the different geological periods. Show fossils and pictures of primitive animals.

Rotation of the Earth.—The ancients believed that the sun, moon and stars moved once a day around the earth. How did they try to prove what they believed? How was it discovered that the earth rotates once a day upon its axis?

What proofs are there that the earth rotates?

Drop a weight from a high tower, and it will be thrown toward the east. Why?

What is the earth's axis? Why is not this axis the longest diameter of the earth? What are the ends of the

axis called? In which direction does the earth rotate? If it rotated toward the west, where would the sun rise? How long does it take for the earth to revolve once? How many degrees does it revolve in an hour? Why do we not feel the movement of the earth? Why do not objects at the antipodes fall off? Do all parts of the earth's surface move with the same degree of swiftness? Why not? Where does the surface move the fastest? Where the slowest?

Revolution of the Earth around the Sun.—Have pupils bring all possible proofs for and against the revolution of the earth.

What would be the result if the earth simply rotated upon its axis, and did not revolve around the sun?

Tell pupils about the apparent changes in the places of the constellations as seen from the earth. The path of the earth around the sun is called the earth's orbit. This path is an ellipse. The sun is at one focus of the ellipse. Illustrate *ellipse* and *foci*. What is the plane of a circle? What is the plane of an ellipse? Illustrate. What is the plane of the earth's orbit? The plane of the earth's orbit is also called the plane of the ecliptic. Illustrate and explain *perihelion* and *aphelion*. The plane of the earth's orbit cuts the sun into two hemispheres. The earth revolves around the sun. In what place does it revolve?

The earth always revolves on its axis, (one axis), and

this axis is always parallel to itself, it always points toward the North Star. Explain.

The axis of the earth is inclined 66½ degrees *to* the plane of its orbit, and 23½ degrees *from* a line perpendicular to the plane of its orbit. Illustrate. Illustrate the path of the earth around the sun. On how much of the earth does the sun shine all the time? Where are the northernmost rays of the sun about March 22d? Where are the southernmost rays of the sun at this time? How long are the days and nights at this time, all over the the earth? Why? Explain equinox.

How many degrees is it from the northernmost rays of the sun to the southernmost? What part of a circle is 180 degrees? Do the sun's rays ever cover more than 180 degrees, north and south, or east and west? Any less? What rays of the sun slant the most? Do these rays always have the same slant? In what direction does the earth move? To the east. In what direction do the northernmost rays of the sun move after the vernal equinox? Explain *vernal.* Why do they move toward the south beyond the North Pole? How far south beyond the North Pole do they go? When do they stop? 23½ degrees south and beyond the North Pole. At what time in the year do they reach this limit? 21st of June. Where are the southernmost rays at this time? How long is a day at this time 23½ degrees from the North Pole? How long is a day at the same time 23½ degrees from the South Pole?

The earth always moves toward the east, and the axis

of the earth always points in the same direction. How do you account for the fact that the most slanting rays are moving north or south all the time? Illustrate by the globe.

After June 21st or the summer *solstice*, which way do the most slanting rays north of the Equator move? The most slanting rays south of the equator? When do the most slanting rays north of the equator reach the North Pole? About the 22d of September. Where are the southernmost rays at this time? What is the length of the days and nights at this time? Explain autumnal equinox. In what direction do the northernmost rays move from this time? The southernmost rays? How far beyond the South Pole do the rays of the sun go? When do they reach the limit of 23½ degrees? Where are the northernmost rays at this time? How long is a day at the South Pole at this time? How long is a night at the North Pole? This is the winter solstice or turning point of the sun, (Wendepunct, as the Germans call it). How long does it take the earth to move from the position in the winter solstice to its position in the spring equinox? How long does it take for the earth to move from its position in the spring solstice clear around the sun to the spring solstice again? Explain leap year. Tell pupils about the signs of the zodiac. When does the sun shine from pole to pole? When does it shine from 23½ degrees south and beyond the North Pole to 23½ degrees north of the South Pole?

What part of the earth's surface does the sun always

shine upon? Why does not the sun shine upon the same parts all the time?

1. Suppose the earth's axis were in the plane of its orbit or in the plane of the ecliptic and always pointed toward the sun; what would be the result? Illustrate and lead pupils to discover.

2. Suppose the earth's axis were perpendicular to the plane of the ecliptic; what would be the result?

3. Suppose the earth's axis were inclined 45 degrees to the plane of its orbit; what would be the result?

What are the advantages of the inclination of the earth's axis $23\frac{1}{2}$ degrees?

Measurement of the Earth's Surface.—It is of great importance to locate exactly places on the earth's surface, and to know exactly how far different places are from each other. This could not be done by using miles alone to measure. For instance you will understand that by using miles alone as a standard of measurement no places could be easily located in the ocean, and indeed many could not be very well located upon the land. A plan has been invented to locate exactly all places on the face of the earth. The measuring by this plan is done by imaginary circles. What is a circle? What is an imaginary circle? What is the plane of a circle? How many degrees are there in a circle? What is 1–360 of a circle? What is 1–60 of a degree? How long in miles is a degree? Why can you not tell the length of degree in miles? There are two kinds of circles of a globe, great circles and small

circles. Illustrate by the great circles on a globe. Through what points do all the great circles except the equator pass? Into what does the plane of each great circle divide the earth? How many great circles could be drawn on the globe? Why can you not tell the number? What is the distance of these great circles (except the equator) from each other? Where are they nearest each other? Where are they farthest from each other? If two great circles are ten degrees from each other at the equator how many degrees are they apart near the poles? How many degrees are there on a great circle from the north to the south pole? One-half of a great circle, measured from pole to pole, is called a *meridian*. How many degrees are there on a meridian from the north pole to the equator? Each great circle measures the circumference of the earth. Small circles are imaginary lines running clear round the globe from east to west. Illustrate. Only one of these circles extending east and west measures the circumference of the globe: which one is that? Where is the equator? How many degrees is the equator from each pole? Into what does the plane of the equator divide the earth? Into what would the plane of any one of the small circles divide the earth? Where are these circles the shortest? Where the longest? In how many ways do the great circles resemble the small circles? In how many ways do they differ? What is the greatest difference? Great circles (except the equator) are used to measure distances east and west around the globe.

Distance is measured from meridian to meridian.

The meridian from which measurements are made is called zero—(0) on the map or globe.

Most maps and globes mark that meridian zero which passes through Greenwich, England. What degree is the meridian that is opposite zero on the globe?

The distances east and west are measured by degrees between great circles, but the measurements take place *on* the small circles. How can you explain this fact? The distance east and west around the globe is called longitude, and the great circles are called lines of longitude.

Small circles are used to measure distances north and south around the globe.

Distance is measured by small circles from the equator which is marked zero like the meridian of Greenwich. The small circles are called lines of latitude.

Longitude east of the meridian of Greenwich is east longitude; west of that meridian is west longitude.

Latitude north of the equator is north latitude. South of the equator is south latitude.

How many degrees of north latitude are there? How many degrees of south latitude? How many degrees of east longitude? Of west longitude?

If you were to travel east on a line of latitude, how far in that direction is it possible for you to go?

In order to locate places exactly on the earth you must use both lines of latitude and longitude. Why? How is a place located by latitude and longitude?

What is a hemisphere?

What divides the earth into hemispheres?

Into what would the plane of the equator divide the earth?

The plane of what great circle divides the earth into the eastern and western hemispheres?

Pupils should answer the following questions by using the small globes on which they have made models of the continents in putty.

What continents are wholly within the northern hemisphere? What continents are wholly within the southern hemisphere? What is the eastern hemisphere? What is the western hemisphere? What continents and islands are divided by the equator? What continents are divided by the meridian of zero (Greenwich)? What continents are divided by the 180th meridian? Is this meridian in east or west longitude? What continents are divided by the 90th meridian east longitude? 90th meridian west longitude? How many degrees apart are these two meridians? Through how many degrees of latitude and longitude does North America extend? South America? Eurasia? Europe? Asia? Africa? Australia? Australasia? Which continent extends over the greatest number of degrees of latitude? Of longitude? Which the least number of degrees of latitude? Of longitude? What meridians extend over the largest plains? What meridians do not extend over continents? What small circles do not touch continents. What small circles extend over the most land surface?

How many degrees of longitude does the sun shine over in a day? How many times does the sun rise in 24

hours? How many times does it set in 24 hours? How many times is it noon? How many times is it midnight? How long does it take for the sun to pass from the 90th degree west longitude to the 90th degree east longitude?

Give pupils several problems of this kind.

How many minutes of time does it take the earth to turn one degree? How far does the earth turn in one minute of time? If it is 12 o'clock over the zero meridian, in how many hours will it be 12 o'clock over the 180th meridian? When it is 12 o'clock over the 180th meridian, what time is it over the meridian at Greenwich? Over the 90th meridian east longitude? 90th meridian west longitude? If you were to travel east, which way would you move the long finger of your watch? Why?

Give pupils a large number of examples in longitude and time.

Over what circle could you travel without changing the time of your watch? If a telegram should be sent from Berlin, Germany, at 8:30 A. M., at what time would it reach New York? If in sailing east you should pass the 180th meridian at 12 o'clock midnight on Thursday, what would you call the next day?

Explain to pupils the way mariners make their reckoning at sea. Explain the *parallax*. See Astronomical Geography, page 19.

SEVENTH GRADE.

It is more than probable that much of the work laid down for the sixth grade must be done in the seventh grade. *The progress of the work depends very much upon the knowledge and skill of the teacher.*

Distribution of heat.—Give pupils lessons in physics upon air, heat, light and the forms of water. By simple experiments pupils should discover the laws of evaporation and condensation of water, effects of heat and the causes of winds.

Why is it warmer in the daytime than it is at night? What time of the day is generally the warmest? Why? Is the sun nearer at noon? Why does it grow gradually warmer from sunrise until noon? Why does it grow cooler in the afternoon? At what time is the sun nearer the earth, in summer or in winter? Refer to the earth's orbit. Why is it warmer in the summer than in winter? When is it generally coldest in winter? Why? When is it generally warmest in summer? Why?

Lead pupils to discover the fact that the effects of heat conveyed by the rays of the sun all depends upon *the slant of the rays.* Draw diagram to show that slanting rays *cover more surface than vertical rays.* The more rays slant the more surface they cover, the nearer vertical they are the less surface they cover. It is warmest where the most rays fall and coldest where the fewest rays fall.

Where are the coldest places on the earth? Why?

Where are the warmest places? Why? What makes the slant of the sun's rays change in the daytime? When in the daytime are the sun's rays the nearest vertical? When do they slant the most? What effects do these different inclinations of the sun's rays have? Why are some days longer than others? When are the days the longest in the year? Where is the earth in its orbit when the days are longest? When are the days the shortest in the year? Where is the earth then in its orbit? When are the days and nights equal in length? Where is the earth in its orbit at that time?

The atmosphere that covers the earth is, some say, fifty miles in depth—it is probably much deeper. The average distance of the sun from the earth in the course of its orbit is 93,000,000 miles. At *Aphelion* it is 94,500,000 miles distant. At *Perihelion* 91,500,000. The rays of the sun have to go through these distances before they reach the earth. The rays pass through immense space unobstructed until they reach the envelope of the earth, the atmosphere. What happens then? The air absorbs the heat in the rays, so that less heat reaches the earth. The longer the distance in the atmosphere through which the sun's rays pass the greater the amount of heat the air absorbs. Which rays pass through the longer distances, vertical rays or slanting rays? Why?

If you were to measure the angles of inclinations of the sun's rays at exactly noon for many days in succession, what would you discover? Illustrate how the

angles change every day? How much does the angle change each day? Very little, measuring by degrees from a vertical line. On what day is the angle the most acute? Draw lines on board and illustrate. On what day in the year is the angle most obtuse? What is the difference in time between the two days?

The inclination or slant of the sun's rays changes *very slowly*; little by little each day. The sun appears a very little nearer the zenith each day or a very little farther from it.

The zones.—*Use the map and globe.* The word *zone* means *belt.* The zones are belts of surface that extend around the earth; they are bounded by the poles and lines of latitude. Zones indicate the general distribution of heat over the earth's surface.

How the zones are bounded.—On the 21st of December where are the northernmost rays of the sun? What circle do they cut on that day? How far is the circle from the north pole? Why is it 23½ degrees? What part of the earth is in darkness on the 21st of December? Where are the most slanting rays south of the equater at this time, 21st of December? To what degree of latitude beyond the equator, do they reach? How many degrees are the most slanting rays south of the equator from the most slanting rays north of the equator? Where are the southernmost rays on the 21st of June? Where are the most slanting rays north of the equator? Why is the Arctic

Circle located $23\frac{1}{2}$ degrees from the north pole? Why is the Antarctic Circle located $23\frac{1}{2}$ degrees from the south pole? How wide are both frigid zones taken together? Over how many degrees of latitude do the vertical rays of the sun shine in a year? What is the northern limit of the vertical rays? At what time in the year are the vertical rays at their northern limit? What are the limits of the slanting rays, north and south, at this time? What is the northern limit of vertical rays called? The Tropic of Cancer. Tell pupils about the constellation of Cancer. What is the southern limit of the vertical rays? Tropic of Capricorn. Tell pupils about the constellation. Over how many degrees of latitude do the vertical rays move in one year? How many degrees north of the equator? How many degrees south of the equator? At what times in the year are the rays vertical over the equator? What are the limits of the slanting rays, when the vertical rays are over the equator. How many degrees in width is the Torrid zone? Over how many degrees of latitude, that are never reached by vertical rays, do slanting rays shine during the year? How many degrees of latitude north of the equator? How many degrees south of the equator? How wide are the two temperate zones taken together? How wide are all the zones taken together?

Describe the changes in temperature from winter to spring. Give causes and effects, from spring to summer; from summer to autumn; from autumn to winter.

Parts of what continents and what natural divisions are in the torrid zones. Parts of what mountain systems?

What plains? What continent has the most surface in the Torrid zones? What peninsulas? What great islands? Parts of what oceans? What river basins are partially in the Torrid zones? Ask the same questions about the Temperate and the Frigid zones. What zone contains the most land? What zone the most water? In what zone is there the least land?

Effects of heat upon the surface of the earth. —At what time in the day is it generally the warmest? Why? Do we have the warmest weather on the 21st of June? The coldest weather on the 21st of December? Why not? If the sun's rays gave all its heat to the air *directly*, what would be the result? Why do we often have very warm summer nights? If the sun's rays did not heat the ground, what would happen after the sun set? Explain the "falling" of dew and the *dew-point*. Lead pupils to discover that the air is mainly heated by the radiation of heat from the surface of the earth; that heat is *stored* in the soil and water by the sun's rays. Explain *conduction*—the imparting of heat from the soil or water near the surface to soil or water below. The sun's rays heat the ground or water, the ground and water impart (radiate) their heat to the air. Which receives the more heat, water or land? Which gives up (radiates) its heat the more rapidly, water or land? What kind of soils receive heat the quickest? What kinds of soil radiate heat the quickest? What kinds of soil radiate heat the slowest? In what kinds of soil does heat reach down the deepest by

conduction? Which is generally the warmer in the day-time, water or land? Why? Which is warmer at night? Why? Which is the colder in winter, water or land? Why?

Effects of heat upon the atmosphere.—Lessons in physics should be given to enable pupils to answer these questions. What is the effect of heat upon air? Why does the expanded air rise? How do you know that expanded air rises? Make several experiments. How far does the air go up? Where does it stop ascending? Why do we open the windows to cool a room? Why does cool air rush into a warm room through open doors and windows? What is wind? What causes the air to move? Air moves up and down (vertically) and from side to side (horizontally). Do you call air moving directly up or down, wind? When does air move up? When does it move down? When does it move horizontally? Is the air moving when you do not feel it?

What part of the earth receives the greatest amount of heat? Why? What part the least? Why? What effect has the intense heat upon the Torrid zone? Immense masses of air are constantly forced up for some distance above the surface. What effect does this expansion have upon the air north and south of the Torrid zone? How far does this movement extend? When does the air move the most rapidly? Where in the Torrid zone is there the most expansion of air? Under the vertical rays. What winds are caused by this move-

ment? How are winds named? There are two great movements of air, one from the south toward the equator, and one from the north toward the equator. In what direction does the earth rotate? What parts of the earth move the fastest? Why? What the slowest? Why? What can you say of the differences in rapidity of movement between the poles and the equator? We will think of a great mass of air moving from the North Frigid zone toward the Torrid zone. The earth is moving on its axis 360 degrees in 24 hours. The air moving south cannot keep up with the movement of the firm earth. It must fall behind. The farther the air goes toward the south the more space must it cover in trying to keep up with the movement of the earth. Why? The moving air or wind constantly falls behind because the earth goes faster than it can go. From what direction do the constant winds of the north and south blow? What do we call these winds? What effect do these winds have upon the temperature of the land over which they blow? They make the temperature cooler, just as the air coming through the doors and windows cools the air in this room.

Where do you think the great mass of air heated in the Torrid zone goes? Why does it not move directly north and south close to the surface of the earth? How far does it go up? Where does it go then? How is it possible for warm air to move toward cold air? By what other force besides heat is air moved? Just think of the tremendous pressure of two immense currents of air moving thousands of miles, one from the north and one from the south. Then re-

member that the great quantities of air leaving the north and south must be replaced. The heated air rises into the cold air above and then owing to the pressure behind it it hurries each way toward the Frigid zone, in mighty currents. These currents of air move one toward the north and one toward the south, but you will see that they do not move *directly* toward the poles at the Torrid zone. These currents of air which begin their movements toward the north and south, move also toward the east with the earth. Why? As they move in northerly and southerly directions the circles over which they pass become, as you know, smaller and smaller; that is, the distances they pass over toward the east become gradually less and less, and the consequence is that these great air currents seem to keep ahead of the movement of the earth; they move faster toward the east than the earth moves. In what directions do they move? North-east and south-east. Which current moves north-east? Which south-east? Winds are not named from the direction in which they move, but from the direction from which they come. Name the wind north of the equator. South of the equator. We have then moving over the earth four mighty currents of air, two move from the poles to the equator; name them. And two move from the equator to the poles; name them. There is a great difficulty which you will see at once. Two currents of air south of the equator, or more strictly speaking, south of the constantly changing vertical rays, move in *opposite directions*. The same is true of the constant winds under the vertical rays. Now the great masses of

air cannot move *against* each other, for if they did one would stop (or neutralize) the other. How do you suppose this difficulty is overcome? The great air currents move over or under each other. There are surface winds, (moving close to the surface) and upper winds (moving above the surface winds). You have seen clouds that move in opposite directions from the surface current, have you not? How do the winds change from an upper current to a surface current, and from a surface current to an upper current?

The northeast and southeast winds, which move steadily from the poles to the Torrid zone, meet at the variable zone or belt covered by vertical rays. In this belt, owing to the intense heat of the sun, a vast current of heated air is constantly rising above the surface currents and flowing over them in either direction: one to the north and the other to the south. Each current of air moves over the opposite surface current until it reaches a parallel of latitude near the tropic of Cancer in the north and the tropic of Capricorn in the south; at these lines the upper currents sink down and become surface currents, moving toward the northeast and southeast over the temperate zones. Within the tropics, the surface winds are from the northeast and southeast. They are called *Trade Winds*. Why?

Within the temperate zones the surface winds are from the southwest and northwest; they are called the *Return Trade Winds*. Why? These winds blow nearly from the west and are also called westerly winds. The great

polar currents start from regions of ice and snow, in their journey toward the south and north as surface currents, but they rise near the polar circles (Arctic and Antarctic) to upper currents flowing above the Westerly and Return Trade Winds until they sink down at the tropics and from the surface winds within the Torrid zone. Whenever the air rises in great masses to form upper currents, or when one current sinks and another rises, there is a belt of calms. In a belt of calms the air does not move horizont-ally, but vertically. Thus there is a belt of calms under the vertical rays; there is another belt of calms, called the Calms of Cancer, and another called the Calms of Capri-corn. Draw a map of the world showing the great wind currents.

This is a *general* description of the winds which blow constantly toward and from the equator. There are how-ever a great many exceptions and modifications of the gen-eral movements of the air. For instance the great equato-rial belts of calms (Doldrums) is north of the equator; the north and southeasterly currents become surface cur-rents north of the tropic of Cancer and south of the tropic of Capricorn; the southwest winds become westerly winds. The most marked exceptions to the general movements of the constant winds are brought about by *the unequal heat-ing of land and water.* Land heats quickly and radiates heat quickly. Water heats slowly and radiates its heat slowly. The land is often warm when the water is cool, and the water is often warm when the land is cool. On some coasts the wind blows to the land from the sea in the

day time, and from the land to the sea during the night. How do you account for these alternate land and sea breezes? On a great portion of the coast of South America and on the western coast of Africa the winds blow from the sea over the land for a season, and then change and blow from the land to the sea for another season? When do the winds blow inland? Why? When do they blow to the sea? Why? These winds are called *monsoons* (seasons).* The principal monsoon in the world blows across the Indian Ocean between Africa and Asia. When does it blow toward and over Africa? Why? When does it blow toward Asia? Why? Another monsoon blows between Australia and Asia. Explain. Tell pupils about the Sirocco Simoon, Texas Northers, Tyfoons, Cyclones, Tornadoes and Hurricanes.

Modifications of heat by elevations.—Why is it colder on mountain tops and great elevations than it is on the plains below? Explain the construction and use of the barometer. How are heights measured by a barometer? Explain areas of low pressure and areas of high pressure. Why is cold air denser than warm air? Why is air near the ocean level denser than air upon heights? What causes density of air? What causes thinness or rarification of air? In what regions can you find all the differences of temperature that you find in all the zones? What mountain tops in the Torrid zone are always covered with

*Monsoons blow over Mexico from and toward the Pacific, and over the Southern States from and toward the Gulf of Mexico.

snow? Name the areas which have a temperate climate in the Torrid zone.

Uses of winds.—Tell me all the uses of winds. What are the most important uses of winds? Which is the most important use—carrying moisture, carrying heat, or carrying cold? Where is the moisture needed? Where is the heat needed? Where is the cold needed? How do the winds carry moisture? Where does the moisture which waters the earth come from? What part of the ocean supplies the most water? Why? What part supplies the least water? Why? From what direction does the moisture come which waters the Temperate and the Frigid zones? What winds bring this moisture? Where does the moisture come from which supplies the Torrid zone? What are clouds? What moves the clouds? Lessons upon the forms of clouds. What is the difference between vapor and clouds? How is the vapor in clouds condensed into rain? Explain how cold mountain tops and high elevations condense vapor? How do the clouds get to the mountain tops? How do cold air currents condense vapor into rain?

Ocean currents.—We have been studying the great ocean of air that completely envelops the earth at a depth of more than fifty miles. We know how this immense mass of air moves in great currents from north to south and from south to north. We have learned, too, the uses of these moving currents; how they carry and distribute

moisture, heat and cold; how they move the sails of ships to their ports; how they bring health and vigor from high to low elevations, and how they sweep away impure air. The ocean, like the atmosphere, is a great moving mass. It does not cover the earth's surface entirely: it is not so easily moved, and it is not so deep as the atmosphere. There are great ocean currents as well as great air currents. Lead pupils to discover the causes of ocean currents. Why does the water of the ocean have a tendency to move toward the equator? What water takes the place of the evaporated water? Why cannot ocean currents move steadily in one direction for great distances like the Trade and Return Trade winds? What effect have the continents upon the ocean currents? Draw chart of ocean currents, study the principal currents, give names, general direction, and shores upon which they infringe. Give all the uses of ocean currents. Show how and when cold and warm ocean currents modify climate. Describe the Gulf Stream.* The Japan current (Kuro Siwo), the Arctic currents.

The constant winds have a great effect upon ocean currents. How? What effect has a violent wind upon the surface of the ocean? Now, if a strong wind should blow constantly, instead of hours and days, in one direction, what effect would it have? What effect has a warm ocean current upon the air that moves over it? What effect has a cold ocean current upon the air that moves over it?

* It has been discovered that a very small part comparatively of the so-called Gulf Stream really passes into and around the Gulf of Mexico.

When a wind moves over and in the same direction with a warm ocean current, what is the result?

Distribution of heat by ocean currents and winds.—The distribution of heat depends principally upon the vertical and slanting rays of the sun; the degrees of slant or inclination of the rays determine the quantity of heat conveyed to any given surface. The slant of rays gradually changes as the earth moves around the sun in its orbit. The nearer vertical the rays, the warmer the surface they fall upon; the farther they are from a vertical line, the colder the surface under them becomes. The vertical rays move over 47 degrees of latitude in one year.

The territory 66½ degrees north of the equator is heated entirely by slanting rays; territory 43 degrees north of the Tropic of Cancer and 43 degress south of the Tropic of Capricorn is under slanting rays all the year round. 23½ degrees north of the Arctic Circle and 23½ degrees south of the Antartic Circle are under the slanting rays of the sun only a part of the year, the remainder of the year the sun does not shine.

The length of the day has much to do with the distribution of heat. A summer day in the cold north or south is very long. How long is a day at the poles? How long is a day in summer at St. Petersburg? At Stockholm? At Berlin? What effect does a number of long days have upon the temperature of a place? Why? It is almost as warm in summer in many parts of the Temperate zones as it is in the Torrid zone.

If the continents were level and there were no great ocean currents nor constant winds, the distribution of heat would be nearly equal along the same small circles, that is, you would find the same temperature at the same time in the year all along each line of latitude. The temperature in Labrador would be the same as in Scotland, but there are great differences in the distribution of heat in the same degree of latitude around the earth. Wherever a warm ocean current goes, it carries heat to the coasts it washes. A cold ocean current carries cold. The same is true of constant winds, especially where they blow over warm or cold ocean currents.

What effect has the Gulf Stream on the climate of Europe? The Arctic Current upon the northern Atlantic coast of North America? Compare the temperature of Labrador with that of Great Britain and Scandinavia. Compare the temperature of different countries under the latitude of 40 degrees north. Compare the climate of different parts of Eurasia under the latitude of 55. Why is Siberia so much colder than Great Britain?

Show pupils chart of *Isothermal lines*, Appleton's Physical Geography, page 66.

Distribution of moisture.—Without rain the continents would be barren deserts. In our study of heat, winds and ocean currents we have had a glimpse of the wonderful machinery by which the continents are watered. The ocean is the great reservoir which supplies the land with moisture; the moving currents of air, the winds,

carry the clouds; the cold tops of the mountains and cold air currents wring out the vapor and scatter it over the land to give nourishment to every living thing. When it has given life to plants by creeping through the soil, it gushes out in springs, flows down in brooks and rivers back again to the great reservoir, the ocean. Wonderful, is it not?

What winds carry the most moisture? Why? What part of the ocean supplies the winds with the most mois-ure? Why? What winds carry the least moisture? Why? When do you find that the largest quantities of rainfall upon the earth? Describe periodical rains; tropical rains. See description of the Llanos, page —.

Draw large map of all the continents and oceans upon the black-board, for the study of rainfall. Color the map, indicating degrees of rainfall as the investigation proceeds. See how far pupils can go, without help, in making this chart. Have them color the putty maps on their little globes as they locate the regions of rainfall.

Most physical geographies contain good charts. The one in Burghaus' Physicalisher Atlas is the best. Ask these and similar questions about each region as it is examined. What winds bring the rain? Over what ocean currents do the winds pass? What effect have the ocean currents (over which the winds pass) upon the moisture carried by the winds? What condenses the vapor in the clouds (over this region)? Does it rain here at all times during the year? Why? Why not? Why has one slope a great rainfall and the opposite slope little or

none? The following classification may assist the teacher.

Regions of Greatest Rainfall.—*Yearly average over 78.74 inches.*

1. Eastern Charts—Western slopes; monsoons.
2. Indo-China, eastern slope; Malay Peninsula; monsoons.
3. Sumatra, Java, Borneo and islands east of—; monsoons.
4. Southeastern China, monsoons.
5. Abysinnian Plateau, monsoons and tropical rains.
6. Basin of Niger, lower parts tropical rains.
7. Coast of the Atlantic near the Gulf of Guinea; tropical rains.
8. Lower part of Brazilian slope.
9. Upper part of Amazon basin and left slope of Orinoco basin; tropical rains.
10. Southern part of the short slope of South America.
11. Eastern coast of Honduras.
12. Northern part of the short slope of North America (South of Alaska.)
13. Northern slope of Guiana.

Regions of great rainfall.— *Yearly average from 51.18 to 78.74 inches.*

1. Great forest region of Africa, including Soudan; tropical rains.

2. Long slopes of South America—including basins of Amazon and Orinoco, with the greater part of the La Plata basin.

3. Isthmus of Panama and region of Central America.

4. South-eastern part of North America, lower part of Mississippi basin, Alabama system, Florida, and Atlantic coast just north of Florida.

5. Eastern slope of Australia.

6. Southern slope of the Himalayas.

7. China, south of the Yang-tse-Kiang basin.

8. Northern slope of the Cantabrians and Pyrenees.

9. Southern slope of the Alps.

10. Caucasus Mountains.

11. Eastern part of Japan Islands.

12. South western part of Scandinavia.

Regions of lesser rainfall.—*Yearly average from 23.62 to 51.18 inches.*

1. Eastern part of North America, including left slope of the Mississippi basin and the lower part of right slope; St. Lawrence basin and eastern part of Hudson's Bay basin.

2. Mexico.

3. Southwestern part of La Plata basin.

4. All Europe, with the exception of the Russian slope and southern part of Spanish Peninsula.

5. Region in Africa north of 10 degrees north lati-

tude, and south of the steppe that borders the Desert of Sahara.

6. Region south of the great Forest region of Sahara, extending to the Kalahari Desert.

7. Mountains of eastern Australia.

8. China, including basin of the Yang-tse Kiang and part of the Hoang Ho basin.

9. Ganges basin, upper part eastern slope of the Deccan.

10. Extreme southern part of Arabia.

11. Eastern slope of Madagascar.

Regions of comparatively little rainfall.—*Yearly average 7.87 to 23.62 inches.*

1. Great basin of North America, Mackenzie basin, and upper part of the right slcpe of the Mississippi basin.

2. Siberian slope.

3. Basin of the Amoor.

4. Upper part of the basin of the Hoang Ho, (not at its source.)

5. Asia Minor, Armenian Highlands and the northern part of the Plateau of Iran.

Region nearly rainless.—*Yearly average under 7.87 inches.*

1. Desert of Sahara.

2. Northern part of the Peninsula of Arabia; southern part of the Plateau of Iran; Plateau of Gobi; a greater part of the basin of the Aral Sea; Basin of the Indus,

with the exception of the mountains at the source.

3. The Kalahari Desert.

4. Kamchatka.

5. Central part of Australia.

6. A long strip of land east of the Andes, extending from Patagonia to north of 30 degree south latitude.

7. Western slope of the Andes, from 32 to about 40 degrees south latitude.*

Distribution of soil and vegetation.—The knowledge of structure and climate leads directly to the study of plant and animal life upon the earth. Plant life depends upon soil, heat and moisture. A general study of the distribution of soils should be the first step in the study of life upon the continents. In order to lead pupils to discover the nature of soils and their distribution, the following classification may be used: 1, very fertile; 2, fertile; 3, arable; 4, cultivable; 5, barren.

Elementary lessons upon the different kinds of soils and their relative fertility should be given. For this purpose specimens of soils, like vegetable mold, alluvial soil, loam, clay, sand, etc., should be observed. A few lessons in the chemistry and composition of soils would be very profitable. The chart of rainfall is a good means of beginning the study.

1. *Very fertile.* All lands in the tropics and sub-

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* It is difficult to describe the regions of rainfall with any degree of accuracy, as the lines bounding them are very irregular and often one region includes another. This classification may assist the teacher in observing the chart of rainfall.

tropics that receive abundance of moisture may be classed under this head. Pupils may easily find these regions on the chart of rainfall. In the temperate zones very fertile soil is found in the valleys of large river basins, as the Mississippi, Yang-tse Kiang, Hoang Ho, Nile,* Ganges,* Po and lower parts of the Volga, Dnieper and Don basins.

2. *Fertile.* Lands that may be classed as fertile are generally in the same river basins with very fertile regions. The lower parts of the basins of great rivers are generally very fertile while the upper parts are fertile.

3, 4. By far the largest area of land surface in the temperate zones may be called cultivable or arable. Arable land by fertilization and good husbandry may be made to produce very fair crops. In most arable regions there are strips of land, usually near rivers (alluvial soil), that are fertile. The St. Lawrence basin, Appalachian slope, northern slope of Europe, Great Britain and Ireland, the upper part of Siberian slope north of the Altai mountains may called arable.

5. *Barren.* Lack of heat and lack of moisture are the two causes of infertility. The chart of rainfall will show the tracts barren from lack of moisture. The frozen regions of the North and elevated regions can be easily found by the pupils. Pupils should be led to investigate the regions lacking rainfall that are or can be made fertile by irrigation. Nile valley, upper part of the right slope of the Mississippi basin; parts of the Great Basin of North America; basin of the Amur Daria, (Oxus); lower parts of

*In sub-tropical regions.

the basins of the Blue Nile and Atbara; part of the desert of Sahara.

In these investigations pupils will get a clear general view of the distribution of soils, and their comparative fertility or sterility.

Now opens a rich field for investigation and study, namely, the distribution of plants over the earth. Pupils who have had elementary lessons in plants all through the course up to this grade, will enter into this study with great earnestness and profit. A simple general classification of plants may be made and the distribution of vegetable life studied from a botanical standpoint. Elementary lessons should be given in botany in this grade. Something should be learned of the nature and growth of vegetation; roots, tubers, stems, trunks, bark, leaves and fruit should be observed. A few terms like *exogenous*, *endogenous*, *deciduous*, should be understood. Lessons should be given upon the different staple vegetable products of the world: like wheat, rice, rye, millet, manioc, bananas, potatoes, maize, sugar cane, cotton, flax, etc. A cabinet or small museum of vegetable products can be made very interesting and instructive; such a cabinet should contain seeds, fruits, leaves, woods, and specimens of prepared food, cloth and other manufactured articles. Profitable lessons may be given to pupils upon foods, and upon materials for clothing and shelter: what they are; where they grow; how they are prepared; are good subjects for investigation and study. *Draw a very large map of the world on the black-board; indicate structure, ocean currents, prevailing*

winds, aud rainfall. Fill up the map with names step by step, as each subject is studied. The distribution of vegetable products may be studied from several standpoints. The pedagogical order is from the general to the particular.

Distribution of vegetation by zones.—*Appleton's Physical Geography, Map pp. 94, 95* gives eight plant zones as follows:

1. Equatorial Zone between the isotherms of 78 degrees north and south.

2. The Tropical Zone between the isotherms of 78 degrees and 69 degrees.

3. The Sub-Tropical Zone, between the isotherms of 69 degrees and 62 degrees.

4. The Warm Temperate Zone, between the isotherms of 62 degrees and 53 degrees.

5. Cold Temperate Zone, between the isotherms of 53 degrees and 42 degrees.

6. The Sub-Arctic Zone, between the isotherms of 42 degrees and 35 degrees.

7. The Arctic Zone, between the isotherms of 35 degrees and 28 degrees.

8. The Polar Zone, from the isotherms of 28 degrees to the pole.

See description of Plant Zones pp. 91, 92, 93.

This classification may be too complex for pupils of the seventh grade. A simpler plan of distribution of plants is taken from *Guyot's Physical Geography* pp. 97, 100. See description, Map pp. 98, 99.

1. Northern Cold Zones.
2. Arctic Zone.
3. Cold-Temperate Zone.
4. Temperate Zone.
5. Warm-Temperate Zone.
6. Tropical Zone.
7. Southern Zones.

Descriptions of the vegetation of each zone should be given orally and read. See Niles' Advanced Geography pp. 43, 44, 45, 46. Our World No. 2, pp. 10, 11, 12, 13. Maury's Physical Geography pp. 102 to 108 inclusive. Voyage in the Sunbeam, by Mrs. Brassey, contains some fine descriptions of tropical vegetation.

Compare the vegetation of the different zones.

Forest lands and grassy plains.—A study of these two divisions may lead to a closer general view of the distribution of vegetable products. Some of the largest areas are given.

1. Tropical forests:
   a. Amazon basin.
   b. Forest region of Africa.
   c. Pine region of North America.
   d. Forests of Northern Europe.
   e. Forests of Central America.
2. Grassy Plains:
   1. Prairies.
   2. Steppes.
   3. Pampas.
   4. Llanos.

Elementary lessons on all the trees within the observation of pupils. Specimens of woods should be collected and lessons given upon the kinds and uses of timber. Lessons on the different kinds of grass and their uses.

Plants peculiar to a very moist climate, and plants peculiar to a dry climate.— The striking differences between the foliage in regions of great rainfall and regions of very little rainfall should be noted. The hanging leaves and leafless trees of Australia, the broad leaves in wet tropical regions, the long roots of trees (Eucalyptus) and grasses searching for moisture in dry soil (grasses used to stop the drifting sand), are excellent topics for discussion.

The botanical distribution of plants is an exceedingly interesting study, but such a study necessitates a long preparation in elementary botany. When elementary science takes its proper and legitimate place in human development, when primary and grammar schools are filled with the study of nature as the basis of all other studies, it will be possible in the seventh grade to study the distribution of plant life in its relations to the science of botany.

Distribution of vegetable products in relation to their use.—

FOOD PLANTS, CEREALS.

Rice,	Rye,
Wheat,	Oats,
Millet or dhurra,	Barley,
Maize or corn,	Buckwheat.

TUBERS AND ROOTS.

Potato,
Manioc (tapioca),
Yam and sweet potato,
Turnip,
Beet,
Carrot.

FRUIT TREES.

Banana,
Date palm,
Cocoa palm,
Orange,
Apple,
Fig,
Bread fruit,
Lemon,
Peach,
Cherry,
Plum.

FRUIT SHRUBS.

Grapes (raisins),
Whortleberry,
Cranberry,
Quince,
Currants,
Prunes.

BEVERAGES, SPICES AND LUXURIES.

Coffee tree,
Tea plant,
Mati,
Tobacco plant,
Indian hemp (hasheesh),
Poppy (opium),
Capirs,
Clove tree,
Ginger,
Nutmeg tree,
Pine Apple,
Olive tree,
Cinnamon tree (bark),
Cayenne pepper (pod),
Cacao (chocolate),
Sago palm (pith),
Mustard (seeds of plant).

NUTS.

Almond (tree),
Walnuts, "
Pecans (tree),
Chestnuts "

PLANTS PRODUCING SUGAR.

Sugar Cane,	Palm (a variety of date),
Sorghum,	Maple tree.
Beet,	

EDIBLE LEAVES.

Cabbage,	Spinach,
Cauliflower,	Dandelion,
Celery,	Water cress.
Lettuce,	

MEDICINAL PLANTS.

Cinchona tree (bark, quinine)	Rhubarb (root),
Cuca (cocoaine),	Castor bean,
Belladonna,	Poppy (opium),
Aloes,	Camphor.

CLOTHING PLANTS.

Cotton,	Jute,
Flax,	Caoutchouc,
Hemp,	Mulberry tree (leaves food of silk worm).

PLANTS USED FOR DYES AND FOR MANUFACTURERS GENERALLY.

Turpentine, Resin } (pine tree),	Linseed oil (flax),
	Indigo,
Gum copal,	Logwood,
Gum Arabic,	Cotton seed oil (cotton plant).
Caoutchouc (India rubber),	

Plants used for shelter.—From trees man obtains the principal plant materials for building; grasses, leaves and shrubs are, however, extensively used. Investigations

should be made by pupils concerning the different kinds of timber used for building and manufacturing. Strength and durability of woods should be investigated. Causes of decay may also be examined.

Questions to be asked in regard to each Vegetable Product. What is it? Is it a tree, shrub or plant? How does it grow? Is it cultivated? Does it grow wild? What are its uses? How is it prepared for use? What is its market value? Where does it grow? Write the name of the product on the map wherever it is cultivated to any considerable extent? In what regions does it grow? In what continents? In what natural divisions, (river basins, plains, mountain systems)? Why does it grow here? (pointing). What kind of soil does it need? Why? What temperature does it need? How much moisture? Tell pupils of the vegetation of former geological periods. How coal, peat, petroleum, was stored up. Stored sun heat.

Review.—Questions should be asked which will review *all* the geographical knowledge which pupils have acquired.

In what regions does rice grow? What kind of soil is needed to produce rice? In what natural division does the greatest quantity of rice grow? Name all the great wheat-growing regions. In what natural divisions is the most wheat raised? What kind of soil do rye, oats, barley and buckwheat need? What cereal is raised principally in the tropics and sub-tropics? What cereals are raised mostly in the Cold Temperate Zones? Rice, it is said, is the principal food of more than one-third of the human

race. Name the principal vegetable products ot the Torrid Zone. Name the tropical fruits. The fruits of the Temperate Zone. What plants produce spices? What plants produce beverages? Where do they grow? What is the most useful beverage? From what plants is whiskey made? Rum and alcohol? Wine? Gin? The leaves of what plants are used for food? Beverage? Luxury? Manufactures? From what plants are oils obtained? What trees furnish food? What beverage? What luxuries? Medicine? What tree is of the most use to mankind? Probably Palm. For how many purposes is the palm tree used? What are the principal trees used in building? What timber is most used? Why? What are the principal woods used in making furniture? Of what kinds of wood are posts and railroad ties made? Why? What are the ornamental woods? Where do they grow? What is the principal wood used in building ships? What in making school desks? For what purposes are the hard woods used? The soft woods? What are raisins? Of what plants is paper made? Flax, hemp, cotton, wood? How is paper made? Visit a paper manufactory if you can. Have each pupil draw a chart of vegetable products. What are the principal plants in a desert? Give the main products of each continent and tell in what natural division of the continent they grow. What vegetable product has any one continent which no other continent has? Where is maize indigenous? The potato? Tobacco? What continent furnishes the most wheat? The least wheat? The most corn? The least

corn? The most grapes? The most manioc? Name all the roots that furnish food or medicine. If you wished to be a farmer to what country would you emigrate? Why? Where would you go to make money by raising cattle? Why? What is the best region in the world for lumbering? Why? For vineyards? For making tar, turpentine and resin? Where are the largest trees in the world? Tell in writing, all the uses of trees. Why are trees planted on our western prairies? What trees furnish valuable gums? What gum is the most valuable? In what country do you prefer to live, excepting, of course, your own home? Why?

Distribution of Animals.—See Elementary Lessons in Physical Geography, Geike, pp. 337, 366, inclusive; Guyot's Physical Geography, pp. 106, 111, inclusive; Maury's Physical Geography, pp. 108, 114; Appleton's Physical Geography, pp. 100, 106; Butler's Physical Geography, pp. 96, 105.

There is no more delightful subject of study for children in the Primary and Grammar grades than elementary zoology. It should begin in the very lowest class, and be continued in all the succeeding grades. The food, homes, habits and uses of animals should be learned, and the adaptation of their forms and structure to their modes of life. Gradually the simplest general classification should be made. If this very important work be done, the pupils of the seventh grade will take great pleasure in learning the distribution of animals over the face of the earth.

Preliminary lessons should be given in zoology in this grade, as a preparation for the study now before us. Pupils should know the general characteristics of the animals in each division and sub-division here given, and something of their structure, forms, food, homes, habits and uses.

1, Mollusks. 2, Radiates. 3, Articulates. 4, Vertebrates. Under Vertebrates, *fishes*, *batrachians, reptiles*, *birds;* under reptiles, *saurians*, *chelonians*, *ophidians;* under birds, *birds of prey*, *perchers, climbers, scratchers, runners*, *swimmers;* under mammals, *marsupials*, *edentata, rodents, pachyderms, carnivora, ruminants, quadrumana cetaceans.*

The migration of birds may be a very profitable subject for discussion and observation in the spring and autumn. From what lands come these birds? Why do they migrate? These questions have not yet been answered by the most scientific observers.

Draw a large map on the blackboard, similar to the one drawn to illustrate the distribution of plants. The latter (map) should remain for comparison. Color the map to indicate the following regions of animal distribution. (See Maury's Physical Geography, pp. 109, 112): 1. The Northern Old World Region. 2. The African Region. 3. The Indian Region. 4. Australian Region. 5. North American Region. 6. South American Region. As each division, sub-division or species is studied and discussed, locate the animals on the map, by writing their names. When a name is written over the locality of an animal,

questions should be asked: Where does this animal live? What does it eat? What food does it find here? Does this animal live on mountains, plains, in forests, prairies, steppes, in marshes, deserts or plateaus? In what temperature does it thrive?

While learning the distribution of animals their uses should be discussed. This classificaton may be used. Animals used for, 1 food, 2 clothing, 3 shelter, 4 draught animals and beasts of burden, 5 scavengers, and destroyers of harmful insects and worms, 6 animals used for manufacturing purposes, 7 useless animals. Are there any useless animals? Do not put too many names of animals on the map. When it is properly finished, these questions can be answered.

Name all the mollusks that you know of. Where do they live? The radiates. Where do they live? The articulates. Where do they live? The vertebrates. Where do they live? Which division is the most useful to man? Name all the fishes, batrachian reptiles that you have ever seen. Which sub-division is the most useful to man? Name all the birds you have ever seen. Name all the birds about which you have read or heard. What family of birds is the most useful to man? Name all the uses of birds. Name all the carnivora you have ever seen. All you have ever heard or read about. Why are some animals called carnivora? What are the uses of carnivora? The greatest use? What rodents have you seen? Name all the pachyderms. What animal is the most useful of this class? Of the least use? Name all

the ruminants. What is the food of ruminants? Which of the ruminants is the most useful to man? Why? Name the quadrumana. The cetaceans. Which subdivision of the mammals is the most useful? Which of the least use? Which the most harmful? Name all the animals used for food. Which supplies the most food to man? For clothing? Which animal supplies the largest quantity of materials of clothing? Name all the fur-bearing animals. Name all the birds whose feathers are used for clothing and for warmth. What bird furnishes the most feathers? Name the animals whose skins are used for leather. To what sub-division does each belong? For what purposes are bones and hoofs used? Name all the articles furnished by swine?

Name all the draught animals and beasts of burden. Which is the most useful? Which is the most intelligent? What draught animals are used for food? The skins of what animals are used for shelter? Name all the scavengers among animals. What animals destroy injurious insects and worms? What birds should be protected? Why?

Name all the articles manufactured out of the bodies of animals. What animal has the most uses? Name all the domestic animals.

Name the animals that live in each one of the six regions and in no other. What animals require tropical heat? What extreme cold? What animals live in all the regions? What animals live on mountains and no where else? Name the amphibious animals. What fishes

are most used for food? What mollusk? Tell pupils about the extinct animals of former geological periods, and show fossils. Show how rocks are composed of shells. Discuss the dispersion of animals by natural and artificial means. What wild animals are related to the cat? To the dog? To the horse? Name the animals that live in one continent and nowhere else? What animals live in forests? What on grassy plains? Write a list of all the animals you have ever seen.

Distributions of Races of Men.—Draw a map of the world on the blackboard; color it to show the distribution of the three types of the human race: 1. The Black Type; 2. The Yellow Type; 3. The White Type. See Appleton's Physical Geography, p. 113. Keep the maps of vegetation and animals on the board for comparison and reference. For subdivisions of types see pp. 68, 69, 70. Lessons should be given upon the peculiar characteristics of each type, such as appearance, manners, customs, habits, dwellings, dress, etc. In what does each type differ from all the others? What countries does each type inhabit? What is the prevailing type in the Torrid zone? In the North Temperate zone? South Temperate zone? Frigid zones? In Asia? Europe? Africa? North America? South America? Australasia? Which type occupies the most land? Which the least land? Tell the pupils about the great changes in distribution. Write upon the map the names of the principal subdivisions of types; discussing each subdivision as you write. The peculiarities

of each should be taught. Show pictures illustrating their appearance, manners, customs, etc. A large number of pictures may be profitably used. What regions are inhabited by negroes? What mountains? River basins? What zones? How came negroes to inhabit a part of North America? In what do negroes differ from the other colored races? What territory next to Africa in extent does the Black Type occupy? Which are the more intelligent, negroes or Australians? Where do the Bantus live? What territory is occupied by the Mongols? What plateau? Mountains? In what natural divisions do the Ostiaks live? The Yakuts? Eskimos? Finns? Lapps? Kirgliz? Funguses? Chukchis? Which subdivision of the Yellow Type occupies the most territory? Which is the most intelligent? Which lives in high lands? Which in lowlands? What territories are inhabited by the American Indian races? When did they occupy all America? In what natural divisions do the Athabascans live? The Caribs? Aztecs? Peruvians? Thrikits? The Patagonians? Fuegians? Tell pupils about the civilization of the mound builders, Aztecs and Peruvians. See Lives of Cortez and Pizarro. Indicate the territory inhabited by the Hamites. The Berbers. The Hindoos. The Sclavic Race. The Romanic Race. The Teutonic. Celtic. The Magyars. What races may be called savages? What half-civilized? What are the characteristics of savages? Of half-civilized peoples? Of civilized men? What races seem to be savages on account of their surroundings, climate, structure, etc.? How does a tropical climate affect

human beings? A frigid climate? Why? In what zone do we find the best civilization? Why? What are Nomads? What prevents Nomads from becoming civilized? What countries are best adapted by their structure for defense against the incursions of savages and other enemies? China, India, Arabia, Palestine, Egypt, Greece, Italy, Spain, Great Britain. Why? Show by the structure of each country how it is adapted to promote civilization.

Distribution of minerals and metals.—The suggestions to pupils in regard to elementary botany and zoology, should be followed in giving lessons on mineralogy in the primary and grammar grades throughout the course. Before the distribution of nations and the various conditions of national life can be comprehensively studied, it is necessary to know where the mineral products are distributed, as they have a very important part in civilization. Give pupils a short course in mineralogy. Study the nature and use of minerals and metals, how they are mined or quarried and the articles manufactured from them. What metal is the most used? Name the uses of iron. What is steel? What is the Bessemer process of making steel? What changes has this discovery brought about? Draw a map, upon which mark the distribution of minerals and metals. When a mineral or metal is studied write its name on the map over the different localities where it is found. In what kind of natural divisions is iron found? Is it ever found in lowlands? How do

you account for the fact that iron is generally found in highlands? In what highlands is it found in the greatest abundance? What metal is most used next to iron? What articles are made of copper? What is brass? In what regions is copper found? What mines furnish the most copper? What are the uses of lead? For what purpose is it most used? In what regions is it found? Name the articles made of tin. Where is tin found? What are the uses of platinum, mercury, zinc, nickel? Where are these metals found? Name the precious metals. Where is gold found? In what is it found? Tell pupils of the various ways of mining gold. Also relate how gold was discovered in California and Australia. Where is silver found? In what mountains? What are the uses of gold and silver? Name the mountains that furnish the largest amount of metals. What regions have a very small quantity of metals or none at all? What kinds of minerals are used in building? What kinds of stone are used the most in construction? Name the different varieties of limestone. For what purpose is slate-stone used? What is the different between granite and limestone? What is marble? For what purposes is it used. What is clay? What articles are made of clay? What is chalk? Where is chalk found? For what is chalk used? Name the precious stones. What is a diamond? Where are pearls found? What are pearls? What is coal? How was it made? What is the difference in formation between soft and hard coal? Show specimens of coal containing fossils. Locate the great coal beds in the

world. Why is it advantageous to find coal and iron in the same locality? What is petroleum? Natural gas? Where are they found? For what purposes are they used? What is peat? Rock salt? Where are they found? Why is the water of the ocean salt? What are the other names for graphite? What articles are made of graphite? Review the distribution of minerals and metals. Write a list of all the uses of minerals and metals to man. What regions have the greatest advantages in the way of minerals and metals? Locate minerals and metals in America; Asia; Europe; Africa; Australia.

Review all the products of the earth, vegetable, animal and mineral.

EIGHTH GRADE.

Distribution of nations.—A series of lessons should be given upon civilization, the development of civilization, and upon nations, national life and growth, and the forms of government of the different nations. These lessons should lay the foundation of a thorough knowledge of governments, politics, and political economy. Pupils have in the seventh grade studied outlines of the histories of India, Arabia, China, Chaldea, Egypt, Palestine, Greece, Italy, Spain and Great Britain as a preparation for the study of the republican form of government and the history of the United States. These lessons form a good foundation for a study of the forms of government. It may be well to take up the study of governments in the order of their growth and development from the first tribal or patriarchal form. One fact should

be taught with great clearness; that any particular form of government depends ideally upon the intelligence and character of the people governed. Ideal government is an adaptation to the condition of the governed. Why should children be governed by their parents until they become of age? What are the essential conditions of self-government? Can all nations govern themselves? Why? Why not? Describe the government of tribes, absolute monarchies, limited or constitutional monarchies and republics. Give lessons upon the three departments of government, legislative, judicial and executive. In what forms of government are all three deparments vested in one power?

SUBJECTS FOR LESSONS.

Forms of Government, Names of Nations—

1. Family,
2. Tribe,
3. Absolute Monarchy,
4. Limited Monarchy,
5. Republic,
6. Democracy,
7. Federation,
8. Confederation,
9. Empire,
10. Kingdom.

Politcal Divisions and Territories in a Nation—

1. Province,
2. Colony,
3. Territory,
4. District, School, Congressional,
5. County,
6. Burrough,
7. Shiretown,
8. Town and Township,
9. Capital,
10. City,
11. Village,
12. Parish.

Departments of Government—

1. Legislative,
2. Judiciary,
3. Executive.

LAWS AND LAW MAKING—

1. Constitution,
2. Suffrage, { Limited, Universal, Majority, Plurality, Cumlative Voting.

3. Courts,
4. Judges,
5. Juries,
6. Common Law,
7. Statutes,
8. Legislatures,
9. Parliament,
10. Congress–House, Senate,
11. Landtag,
12. Reichstag,
13. Elections,
14. Town Meeting,
15. Caucus,
16. Convention,
17. Prisons,
18. Banishment, Exile,
19. Capital Punishment.

REVENUE—

1. Tariff, { High, Low. For Protection, for Revenue only.
2. Free Trade,
3. Taxes,
4. Internal Revenue,
5. Customs.

MEANS OF DEFENSE—

1. Standing Armies,
2. Militia,
3. Volunteers,
4. Regulars,
5. Infantry,
6. Cavalry,
7. Artillery,
8. Engineers,
9. Navy,
10. Police,
11. Sheriff,
12. Mayor.

RULERS, OFFICERS AND TITLES—

1. Emperor,
2. King,
3. Kaiser,
4. Czar,
5. Chief, Patriarch,
6. President,
7. Cabinet,
8. Embassador,
9. Consul,
10. Duke,
11. Lord,
12. Viscount,
13. Marquis,
14. Count,
15. Baron,
16. Senator,
17. Member of Congress,
18. Judge,
19. Knight,
20. Squire.

PARTIES AND CLASSES—

1. Aristocracy,
2. Autocrat,
3. Tyrant,
4. Classes,
5. Caste
6. Democrat,
7. Whig,
8. Republican,
9. Tory,
10. Liberal,
11. Home Ruler,
12. Prohibitionist,
13. Free Trader,
14. Mugwump,
15. Free Soiler,
16. Abolitionist,
17. Socialist,
18. Nihilist,
19. Anarchist.

EDUCATION—

1. Schools,
2. Universities,
3. Colleges,
4. Common Schools,
5. Private Schools.

RELIGIONS—

1. Christian,
2. Mohommeden,
3. Buddhist,
4. Brahmin,
5. Fetish,
6. Totem.

GENERAL TOPICS—

1. Civilization,
2. Dark Ages,
3. Rome,
4. Greece,
5. Feudal System,
6. Slavery,
7. Serfdom,
8. Nomads,
9. Emigration,
10. Immigration,
11. Secession,
12. Capital and Labor.

Questions. What is a nation? What is the difference between a race and a nation? How many kinds of government are there? What kind of government requires the greatest intelligence and character in its people? Why? What requires the least intelligence? Why?

Name the departments of Government? In what form of government does the ruler exercise the functions of all departments? Which is the most important department? Why? What is a constitution? What legislators are not elected in a limited monarchy? What is the difference between a republic and a democracy? A federation and a confederation? How are chiefs of tribes selected? What is the difference between the English Parliament and our Congress? What is a congressional district? How many inhabitants must there be to form a congressional district? How are towns governed? Cities? What is the right of suffrage? How is this right limited?

At what age can a man vote in the United States? Should women vote? Why? Why not? What are equal rights? What should be the qualifications of a voter? What is a caucus? How are laws made? What is the use of laws? What is a jury? What is capital punishment? Is it right? What are taxes? What is tariff? Internal revenue? What is free trade? Which is better for a nation free trade or high tariff? Why? What officers in this country are elected? What appointed? Is it right for a nation to keep a standing army? Why? Why not? Name the officers in our regular army and give their relative positions. Should there be any classes or castes in a nation? Why? Why not? Why should all the people of a nation pay for common schools? What does "each for all, and all for each" mean? What is a citizen? Why should people who do not vote pay taxes? What is toleration in religion? In what should all persons be equal? What is monopoly? How much poverty would there be if the Golden Rule were strictly obeyed? What is the very best gift that a nation can make to every child? Why is true education better than riches, fame or an inherited title?

Civil Government.—A course of well prepared lessons in civil government should here be given. Pupils ought to be brought, face to face, with their political rights, and duties; there indeed is no more important work of the common school than the study of the citizen's relations to his country. The course should begin with the

government of the town or city in which the pupils live; follow this with the government of the county, then the state and the nation. Questions like the following indicate the general direction of the course. Of what does the government consist? What officers are elected? How are they elected? What officers are appointed? What are the duties of each officer? What kind of citizens should be selected for office? What are the duties of a legislator? How are laws made? What is an executive officer? A judicial officer? What is a constitution? What laws can a town or city make? A state? The nation? What is centralization? State rights? Compare the government of the United States with other governments. What is bribery? What effect has bribery upon a nation? How can the government be kept pure? Why should every citizen vote? *Study the Constitution of the United States.*

Political divisions.—If the plan here given has been followed, and the work done, pupils are ready to take a comprehensive view of all political divisions. The maps on the board of the distribution of plants, animals, races, and minerals, together with the relief globes the pupils have molded—may be used for the boundaries of political divisions. Red crayon should be used to mark the boundary lines, thus conforming to most printed maps. The plan of classification has been discussed in "The Preparation for Teachers."(See pp.——.) With pupils of this grade the best plan is to begin with the tribes, and

follow with absolute monarchies, limited monarchies and republics. The boundaries of territories inhabited by peoples under purely tribal forms of government can only be very indefinitely indicated. Most maps have boundary lines to limit territories in savage Africa:—it is quite safe to say that not one mile of political boundary except the sea-coast, is accurately known of Africa, even supposing such boundaries to really exist. The latest boundaries may be used with this very marked qualification, *somewhere near this line.*

Descriptions of political divisions.—As each political division is marked off on the map—the country bounded should be described by pupils. The power to describe accurately, using all the knowledge previously acquired, is an excellent test of what pupils have learned.

Maps of all the continents are on the board, the teacher with red crayon marks off a political division and requires pupils to write a description of the division. They already know the structure, climate, vegetation, animals, races, and minerals of the whole continent, therefore they can describe each political division.

The description of political divisions can be made an exceedingly valuable exercise in thought, logical arrangement, writing, and language. The order of description is from the general to the particular, and pupils should be held to the order.

Schedule of plan of description.—

POSITION—

In relation to continent.

On what slope?
In relation to ocean,
In what zone?

STRUCTURE—

Primary highlands (if any),
Secondary highlands,
Plateaus,
Principal mountain peaks,
Plains.

DRAINAGE—

River basins,
Lakes and inland waters,
Rivers.

OUTLINE—

Natural boundaries—(Coast lines and mountain ranges,)
Peninsulas,
Islands.

CLIMATE—

Position in zone,
Height affecting temperature,
Winds affecting temperature,
Rainfall,
Winds that bring moisture,
Causes of lack of moisture (if any),
Average temperature in winter,
Average temperature in summer,
Tropical, sub-tropical, warm, temperate, cold, temperate or frigid.

VEGETATION—

Soil,
Causes of condition of soil,
Very fertile, fertile, arable, cultivatable, or barren.
Principal products (see classification),
Forests,
Grassy plains,
Principal exports,
Animals.

MINERALS—

Locate mines,
Extent of mines,
Principal products,
Minerals exported.

RACES OF MEN—

Locate,
The ruling race.

GENERAL—

Advantages for the homes of men,
Disadvantages,
Scenery,
Present state of civilization,
Probable future.

This schedule should be written on the board for pupils to follow in writing their descriptions. An examination of the written papers will show the teacher how faithfully the work of the seven preceeding grades has

been done. Important features and details of structure, climate, etc., not in the general work (continent as a whole) should be taught as each political division is taught. A brief sketch of the history and development of each nation as it is taught should be related or read. Teach the provinces, colonies, and dependencies with the nation controlling the same, as India, Canada, etc., with Great Britain.

The present population and area in sq. miles of each political division should be written on the map over the locality for reference and comparison.

Questions. Write the names and locate all the political divisions in the world. Name and locate the countries in which the tribal form of government prevails. What races inhabit these countries? Name and locate the absolute monarchies? What races inhabit these political divisions? Name and locate the limited monarchies. The Republics. What is the area in square miles of all the countries under the tribal form of government?

Pupils can copy areas from the board. Areas of all the limited monarchies taken together. Republics. Under which form of government is the largest area of land? The smallest? Under which form is the greatest number of people? The least number? What nation has the largest area of land? The next in area? The next? The smallest? What nation has the greatest number of inhabitants? The next in number? The next? The least number? What nation is made up of the most races? The fewest? In what nation does the black type

prevail? The white? The yellow? In what political division does the Latin race live? The Teutonic? The Celtic?

Locate and bound the Russian Empire. The British Empire. What fraction of the earth's surface do these two empires occupy? Which has the larger area? The greater population? Name four political divisions next in order of size, (area) smaller than the British Empire. Name five of the greatest nations in order of the number of inhabitants in each. What political divisions are wholly upon highlands? What nearly upon highlands? What political divisions contain the largest plains? What political divisions are upon Atlantic slopes? Pacific slopes? Arctic slopes? What political divisions slope towards the Atlantic and Pacific oceans? What towards the Indian ocean? What political divisions are upon peninsulas? Islands? What political divisions have no sea-coast? What political divisions have the longest coast-line in proportion to their areas? What the shortest? What political divisions have the greatest number of good harbors? What nation has the largest area of land in one mass? What nation has provinces in all the continents? What nation has the most islands? What political division has the largest river basin? What the greatest number of large rivers? What the best advantages for river navigation? What have no large rivers? What nations have the best natural means of defense against enemies? What the poorest?

What political divisions have the best advantages for

commerce? The poorest? What political divisions have the most land in the Torrid zone? In the North Temperate zone? South Temperate zone? Frigid zones? The temperature of what political divisions are affected by highlands? What divisions are warmed by ocean currents? Cooled by ocean currents? What divisions are colder than other countries in the same latitudes, on account of the distance from the ocean? Over what political divisions does 40° north latitude pass? Which division has the highest average temperature? Why? Ask the same questions of 50° north latitude Over what political divisions does the equator pass? The Tropic of Cancer? Capricorn? Arctic Circle? What political division has the greatest average rainfall? What the least? What divisions receive their moisture from the monsoons? The return trades? What divisions have tropical rains?

What political divisions are partially barren on account of lack of heat? What are barren on account of lack of moisture? What divisions have the most fertile land in proportion to area? What the least? What political divisions have no barren land? What have the largest area of barren land in proportion to the entire area? In what political division is the most rice raised? Wheat? Corn? Tobacco? Cotton? Potatoes? Rye, oats and barley? In what is the most lumber? Iron? Copper? Silver? Gold? Coal? Lead? In what divisions are the most grapes raised? Cocoa-nuts? Tropical fruits? Dates? In what divisions are there the most cattle?

Hogs? Horses? Elephants? Camels? Wild animals? What divisions have the best advantages for fishing? What divisions have the best advantage for agriculture? Grazing? Mining? Have pupils write the names of five political divisions which have the best advantages in every direction, structure, climate, soil, vegetation, animals, and give reasons. Have pupils find the average number of people to a square mile in each division. What division is capable of supporting the greatest number of people to a square mile? The least number?

Occupations of Men.—The study of *man at work* should have a very prominent place in the school-room. The conditions, advantages, disadvantages and necessities of labor may be inferred from all previous lessons, up to a certain point in the development of the human race, structure, climate and other essentials of environment, "control the growing life of man," then comes development through the mastery of adverse circumstances by work, work directed by thought. "Thou hast put all things under his feet." The history of labor is the history of man; it can he traced from the rough, gnarled limb of a tree, used to cultivate the soil, up to the steam-plow; from the rude sickle to the reaper that cuts and binds; from the goose quill to the magnificent printing press. Closely allied to manual training as an essential to education, is the deep interest that should be aroused in the minds of all children in the hand-work and brain-work which rolls the car of progress onward. A growing appreciation of

the great dignity and worth of labor to mankind should be developed in all children.

Outline of lessons upon occupations.—

AGRICULTURE—

Farms,
Plantations,
Modes of cultivating the staple crops:
  Wheat, Rice, Corn, Coffee, Tea, Grapes, Cotton, etc.,
Farming Utensils and Machinery,
Modes of converting raw materials to
  Food, Clothing, etc.,
Fertilizers,
Agriculture in the Tropics,
Agriculture in the Temperate zones.

GRAZING AND THE RAISING OF ANIMALS—

$\left.\begin{array}{l}\text{Cattle,}\\ \text{Sheep,}\\ \text{Hogs,}\\ \text{Camels,}\\ \text{Horses,}\\ \text{Ostriches,}\\ \text{Fowls,}\end{array}\right\}$ How raised?

Cattle Ranches,
Nomads,
Pastures.

FISHERIES—

Kinds of Fish used for food.

How caught and prepared for the market,
Whale Fisheries.

MANUFACTURES—

Articles manufactured for
Food,
Clothing,
Shelter,
Household Utensils,
Furniture,
Uses in Transportation,
Luxury,
Medicine,
Factories,
Flour Mills,
Machine Shops,
Rolling Mills,
Water-Power, Steam,
Wooden Ware,
Paper,
Cotton Goods,
Woolens, etc.,
Printing,
Gas,
Oils,
Electricity,
Paints.

Pupils should visit all the principal manufactories

near the school, observe the machinery and processes of manufacture and write detailed descriptions.

LUMBERING—

How Forests are cultivated,
Processes of cutting and logging,
Rafting,
Saw Mills,
Principal kinds of woods, used in,
Building,
In making Furniture,
Ships,
Railroads.

COMMERCE—

Ships, how made and launched,
Steamboats,
Great Ocean Routes, (See map Barnes Complete Geography. pp. 132, 133,)
Advantages taken of winds and Ocean currents,
Harbors,
Railroads, how made?
The Iron Horse,
Cars,
Freight,
Tunnels,
Air-brake,
Railroad Accidents. How caused?

Canals, Canal Locks,
Stage Coach,
Caravan,
Flat-boats,
Canoes,
Dog-sleds.

BUSINESS—

Banks,
Mints,
Corporations,
Boards of Trade,
Chambers of Commerce,
Exchange,
Bank-notes,
Coin,
Bank-checks,
Drafts,
Merchandise.

ART—

Sculpture,
Painting,
Architecture,
Engraving.

PROFESSIONS—

Theology,
Law,
Medicine,
Teaching,
Engineering.

Questions—What is commerce? Why is commerce a necessity? Define imports. Exports. What are surplus products? What does a country export? Import? What are the great ocean routes of commerce? How has the Suez Canal changed routes of commerce? What changes will the Panama Canal bring about? What nations employ the most men in proportion to number of peoples in commerce? Why? What nations have the least advantages for commerce? Where are the great manufacturing centers of the world? Give reasons why? What nations have the least advantages for manufacturing? State all the conditions for a manufacturing center. What political divisions have the greatest number of people in proportion to population, employed in agriculture? What regions are devoted, almost entirely, to raising cattle?

What is a city? What is the difference between a city and a village? A city and a town? Describe how cities are founded, and how they grow? What conditions are necessary for the founding and growth of cities? What is a commercial city? What constitutes a good harbor? What other conditions with a good harbor does a commercial city need? How does commerce depend upon agriculture? Upon manufacturing? Upon railroads? How has the building of railroads changed the commerce of the world? Name and locate twenty of the largest sea-ports in the world. The cities should be located on the map, and the population given in figures written on the maps. Name and locate ten of the largest inland commercial cities. Name and locate fifteen of the

largest manufacturing cities. Name and locate ten cities which owe their greatness to neither commerce nor manufacturing. In locating cities use the physical wall maps.

Questions upon cities as they are located.— *Commercial Cities.* What are the exports? To what ports are they carried? What are the imports? From what ports do they come? Describe the harbor. What are the railroad facilities of this port? From what regions is freight brought overland to ship at this port? What are the principal manufactures? Pictures of the principal cities should be shown and things of interest related. What advantages for growth and prosperity has this city?

Manufacturing Cities. Describe the location and surroundings of the city. What are its principal manufactures? Give the advantages it has for its manufactures. Where are its manufactured articles used? Where the great manufactories of iron and steel products? Cotton goods? Woolen goods? Cutlery? Agricultural implements? Name a city that is great without any natural advantages. What cities have been made great by railroads? What causes can you give for the greatness of cities that have neither commerce, nor manufacturies to any considerable extent? Name and locate five cities made famous by universities and other institutions of learning.

General. A ship is loaded with wheat, from what ports may it come? Cotton? Hides? Mahogany and Rosewood? Tea? Coffee? Furs? Meat? Rails for

railroads? Copper? A ship is registered from Canton, what is its lading? Buenos Ayres? Bahia? Rio Janeiro? New York? New Orleans? San Francisco? Halifax? Liverpool? Havana? Georgetown, (Guiana)? Santiago? Marseilles? Bordeaux? Hamburg? Constantinople? Melbourne? Calcutta? Tokio? Coomassie? Tunis? Batavia? Sitka?

From what ports come Rice? Wheat? Corn? Meat? Copper? Coal? Marble? Coffee? Tea? Jute? Cocoa? Sugar? Fish? Spices? Oranges? Wine? Tobacco? Ivory? Furs? Where are ships made? Railroad cars? To what countries do emigrants go? Why? From what countries do they come? Why? Name all the regions of sparse population, that can be made good farming land. What have railroads and steamships done to help mankind? In what way does material wealth civilize mankind?

BOOKS AND MAPS.

Explanation: ** Excellent; * Good; p, Pupils; t, Teachers.

MAPS AND ATLASES—

Stanford's Physical Wall Maps. The best for structural geography, London.

Guyot's Physical Wall Maps. ** Ivison, Blakeman & Taylor.

Johnston's Physical Wall Maps. Cheap and good.

Stieler's Hand-Atlas.**

Schedler's Relief Map of United States.

Relief Maps of the Continents. ** E. H. King, River Falls, Wis.

Berghaus' Physicalischer Atlas. The best in the world. Gotha.

Cook County Normal School Relief Maps. Englewood, Ill. Maps of the Continents, in plaster and putty.

Very fine Relief Map of United States, in plaster, with frame.

THEORY—

Life of Ritter,** *Gage.*

Comparative Geography, ** *Ritter.* Van Antwerp & Bragg.

Geographical Studies, *Ritter.*

Earth and Man, ** *Guyot.* Scribner.

These four books present the general plan of what may be called the scientific geography.

Teaching of Geography, * *Geike.* Macmillan.

Guyot's Common School Geography, Teachers Edition.**

Der Geographische Unterricht,* *Oberlander.* Follows the theory of Ritter.

Der Method de des Geographische Unterricht, *Bottcher.* Berlin.

Geographie als Wissenschaft u. in der Schule, *Dronke.* Bohn.

Zur Methodik d. Geograph. Unterricht, *Gelhorn.* Leipzig.

Methodik d. Geograph. Unterrichts, *Matzat.* Berlin. Opposed to Ritter's plan. Very systematic and full of suggestions for field lessons and primary math. geog.

Methodik d. Geograph. Unterricht, *Rusch.*

Methodik d. Geographic Unterricht, *Schwarz.*

Methods of Teaching Geography, *Crocker.* Many good suggestions.

Methodische Ansichten Uber den Stoff, die Behandlungs—weiśe der Geographic, *A. V. Roon.*

Der Unterricht in der Geographie, *Bormann.*

Ueber die Geographie als Lehrgegenstand in den Schulen, *Shacht.*

Die Methodik der Erdkunde, *Ludde.* Magdeburg.

Geschichte der Methodologie der Erdkunde, *Ludde.* Leipzig.

Methodik des Geographischer Unterrichts,* *Winkler.* Dresden.

Grundzuge der Erdbeschreibung mit besonderen Rucksicht auf Natur= und Volkerleben, ** *Bormann.* Leipzig.

Leitfaden fur dem Unterrichte in der Vergleichenden Erdbeschreibung, *Putz.* Freiburg.

Geography with Sand Modeling. A. E. Frye.

COMPREHENSIVE STUDY—

The Earth and Its Inhabitants, ** *Reclus.* 12 vols. Appleton. The most exhaustive work upon the whole subject published in English.

Stanford's Compendiums of Geography and Travel. 6 vols. One for each continent. ** *Stanford.* London. A very valuable work for teachers.

Articles in the Encyclopedia Brittanica. ** While most encyclopedias like Appleton's and others contain much that is instructive upon geography, the Brittanica is a genuine mine of geographical knowledge.

Harper's Magazine. ** Bound volumes, with Index. For reading and study in the 7th and 8th grades, there is no better Cyclopedia than the bound volumes of this magazine. The Index enables pupils to find good reading upon very many subjects.

The Century, bound volumes. A fine acquisition for a school library.

Brown's Countries of the World. * 6 vols. Good reading for the 6th, 7th, and 8th grades.

Brown's Peoples of the World. * 6 vols. For eighth grade.

Geography—Physical, Historical and Descriptive, ** *Keith, Johnston,* Stanford.

Bird's Eye View of the World, ** *O. Reclus.* Ticknor & Co.

PHYSICAL GEOGRAPHY—

Physiography, ** *Huxley.* Appleton. Excellent in method and matter.

Elementary Phys. Geography, *Geike*. To be read after considerable investigation and observation; field lessons.

Phys. Geography—Elementary lessons in: questions on, ** *Geike*. Macmillan.

Water—Forms of Water, *Tissandier*. Scribner.

The Earth, ** *Reclus*. Harper.

Physical Geography, *Somerville*.

Parallelismus dér Flussysteme Europas, Asiens, Afrikas und Amerikas, *Bronner*.

Six Lectures on Phys. Geography, *Houghton*. Longmans.

Geographisches Lesebuch, *Masius*. Halle. Collection of excellent extracts from various authors.

Nene Problems der Vergleichender Erdkunde, *Peschel*. Leipzig. Very good for structure.

Schriften zur Allgemeinen Erdkunde, *Kriegk*. Leipzig.

Relations of Climate and Structure to Civilization.

Phys. Geog. Earth as Modified by Human Action, *Marsh*.

The Atmosphere, *Flammarion*.

Die Erde als Weltkorper ihre Atmosphare u. Hydrosphare, *Hann*. Leipzig.

Appleton's Physical Geography. ** For the best outcome of modern science.

Bulter's Physical Geography.

Maury's Phys. Geog.*

Niles' Advanced Geography, * Merrill.

Physical Geography, *Young*. Putnam.

Physical Geography, *Macturk*. Putnam. 156 pages. Full of important facts.

Physical Geography, *Monteith*. Barnes.

Student's Atlas of Physical Geography, ** *Bryce*. Putnam. (With explanations.)

Houston's Physical Geography.

Class Book of Physical Geography, *Hughes*.

Volcanoes, *Judd*. Appleton.

Dynamical Geology—

Geology, *Geike*. Macmillan. Shows the history of relief.

Geological Story, Briefly Told,** *Dana*.

Handbook of Physical Geology, *Brown*. Bohn.

Geological Excursions,** *Winchell*. Griggs.

Town Geology, *Kingsley*. * Appleton.

First Book in Geology, ** *Shaler.* Heath. Very good for elementary lessons in geology.
Compend. of Geólogy, *Joseph Le Conte.*
Climate and Cosmology, *Croll.* Appleton.
Sketches of Creation, *Winchell.* Harper.
Geologische Bilder, *Cotta.* Léipzig. Influence of structure and climate upon the life of man.
Formation of Vegetable Mould, *Darwin.*
Climate and Time, *Croll.* Appleton. (Discussions of Surface Formation, Climate.
Handbuch der Klimatologie, *Hann.*
Geography of Coast Lines, *Lawson.*
Landschafts Kunde, *Oppel.* Breslau.

THIRD GRADE—

Seven Little Sisters, p. ** *Andrews.* } Lee & Shepard.
Each and All,** " }
Little Lucy's Wonder Globe, p. *Yonge.*
Little Folks of Other Lands, p. *Chaplin and Humphery.*
Children of all Nations. p.
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Children's Fairy Geography, *Winslow.* p.
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Japan, t. *Reed.*
Japan, t. *Reiss.* Scientific. Complete description.
Bear Worshippers of Yezo, *Greey.*
Siberia, *Atkinson.*
Description of Siberia, * * *Krapotkine.* En. Britanica.
Exiles of Siberia, * * *Kennan.* Century, May, 1888, and following.
Land Journey Throngh Siberia, t. *Collins.*
Overland Through Asia, p. *Knox.*
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Arctic Voyages, *Nordenskiold.*
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An Arctic Province, p. *Elliott.*

MATHEMATICAL GEOGRAPHY—

Astronomical Geography, p. * * *Jackson.* Heath.
Astonomy Primer, p. *Lockyer.*
The Heavens, t. *Guillemin*, pp. 81, 109. Putnam.
Populare Astronomie, t. *Preussinger.* Stuttgart.
Populare Himmelskunde and Astronomische Geographie, t. *Diesterweg.* Berlin.
Die Mathemattscher Geographie, t. *Koppe.* Essen.
Allgemeine Erdkunde, t. *Hann*, *Hochstetter*, *Pokony.* Math. Geog. Climate Biology. * *

Grundzuge d. Mathemat, Geographie f. Lehrer, t. *Oberfeld*: Wittenberg.

Method, Lehrb, f. d. ersten Uunter in d. Math. Geogr., *Heckenhayn.*

Leitf, d. Mathemat Physikal Geographic, *Geistbeck.* Freiberg.

Astronomical Geographie, Elementary, *Bartholomai.* Langensalza.

Physiography, * * *Huxley.*

VEGETATION—

Origin of Cultivated Plants, t. *De Candolle.* Appleton.

Vegetation der Erde, t. *Grisebeck.*

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Pflanzenleben der Erde, t. *Labsch.* Hannoad.

ANIMALS—

Geographical Distribution of Animals, t. *Wallace.* Scientific.

Distribution of Animals, t. *Heilpreni.* Appleton.

Geographische Verbreitung der Thiere, *Schmada.* Wien.

GENERAL READING FOR PUPILS—

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Blackie's Geographical Readers.

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PRODUCTS—

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Commercial Products of the Sea, *Simmonds.*

Resources of the Pacific Slope, *Brown.*

Animal Products, *Simmonds.*

EIGHTH GRADE—RACES OF MEN—

Standard Natural History p.** *Kingsley*, vol. vi., Man.
The Peoples of the World, *Brown*,* 6 vols.
Manual of Ethnology, t. *Brace*. London.
Origin of Civilization and the Primitive Condition of Man, t. *Lubbock*. Appleton.
The Dawn of History, t.* *Keary*. Scribner.
Races of Men, t. *Pickering*. Bohn.
The Races of Man and their Geographical Distribution, t. ***Peschel*.
The Human Species, t. *Quaterfrages*. Appleton.
Anthropology, t. *Topinard*.
Anthropology,** *Tylor*.
Man and his Handiwork, *Wood*.
Man's Origin and Destiny, *Lesley*, Harper.
Ideen zur Geschichte der Menscheit.** Herder.
History of Civilization, t. *Buckle*.
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Fossil Men and their Modern Representatives, t. *Dawson*.
Geographie des Welthandels, t.
Commerce, *Andree*. Stuttgart, t.
Die Ruckwirkung der Lander—Gestaltung auf die Menschichte Gesittung,** *Peschel*. Wien.
The Aztecs, *Biart*.
Geographie u. Geschictle, *Jarz*. Wier.
Authropo, Geographie, *Ratzel*. Stuttgart.

GOVERNMENT.

Our Governments,** *Macy*.
Civics for Young Americans, p.** *Giffin*. Lovel.
Politics for Young Americans, p. *Nordhoff*. Harper.
American Politics, p. *Johnston*. Holt.
Democracy in America, t. 2 vols. *De Tocqueville*
The Nation, t. *Mulford*.
Progress of Nations, t. *Seaman*. Scribner.
Nearly all the reading for 5, 6, and 7th grades may be used for the 8th grade.

SPRING STUDIES IN NATURE.

BY MRS. E. D. STRAIGHT—COOK COUNTY NORMAL SCHOOL.

PLANTS—POINTS TO OBSERVE.

I. General conditions of plant growth—heat, light, moisture, ventilation.

II. When does the sap begin to rise in trees and shrubs? What evidence? What cause?

III. BUDS.—When do buds begin to swell? Are all the buds on the same plant equally developed at the same time? Is there any law of development? Examine many plants and different species before forming conclusion. Notice position and arrangement of buds on stem. Is the arrangement the same on all twigs of one plant—of one species? Covering of buds—scales, varnish, cottony or woolly substance. For what purpose? Observe folding and arrangement of leaves in bud; in different plants; length of time required for the development of the bud into leaves, branch or flowers. Watch the development of some bud from day to day throughout the season. Notice the relation of buds to leaves of preceding year. In small herbaceous plants, notice the appearance of buds above the soil, how they penetrate the soil, their treatment of obstacles as roots or other substances in their way.

IV. STEMS.—Compare with regard to size, color, shape, texture, surface, etc., stems of one year's growth, with those of two years' growth, three years' growth, etc., on the same plant. Observe in woody twigs the bark, wood and pith, the number of layers in the bark, the surface, color, thickness and structure of each layer. Observe of the wood—color, surface, hardness, structure, number of rings seen in cross section. From the number of rings what conclusion drawn as to the age of the twigs? Compare stems of plants growing in the same locality under different conditions—as in shade or sunshine, etc., in marshy places and in sandy soil. Can you form any conclusions? The stems of what plants die with the leaves? Compare stems which grow above the ground with subterranean stems. Measure the growth of some stem by marking it from day to day, and observe conditions under which it grows most rapidly.

V. LEAVES.—Observe whether leaves appear before, with, or after the blossoms on the same plant or same species. Position on the stem. Attitude with regard to stem—whether upright or drooping, etc.; also, angle at which they spring from the stem.

Compare rapidity of growth and size of twigs with the number of leaves they bear. Is there any law? Compare the two surfaces of the same leaf as regards color, texture, etc. What is the cause of this difference? Compare different leaves on same plant as to size, shape, color, etc., especially those which grow on subterranean stems with those growing on aerial stems.

VI. FLOWERS.—Do they appear before, with, or after the leaves on the same plant? Does the plant blossom the first or the second year? Does it bear perfect, monœcious or diœcious flowers? Do the pistils and stamens mature at the same time in the same blossom or on the same plant? If not, which matures first? Can you find any law? Notice the form of the flower cluster, its position with reference to the stem, arrangement of flowers. Is there any law? Is the flower conspicuous because of color, fragrance, etc.? Is it inconspicuous? Notice the abundance of pollen. Means of fertilization. By what insects visited, and for what purpose. Notice length of blossoming time of single plant, of species—making note of date of appearance of first and of last blossom.

VII. FRUIT AND SEED.—What length of time is required to ripen the fruit after the blossoms appear? What is the kind of fruit (whether dry or fleshy, etc.)? Attractiveness to insect or other animal visitors. If dry, notice the modes in which the pods split to release the seed. Observe modes of distribution of fruit and seed (wind, insects or mechanical means). Observe the proportion existing between the number of blossoms and the number of perfected fruits on the same tree. Compare different trees of the same species. Compare trees with herbaceous plants. Find law. What seeds sprout as soon as fruit is ripened and they reach the proper surroundings? Notice the length of time required for germination. What are the conditions of germination? Observe whether the cotyledons appear above the ground or not; notice also changes in color, size, shape, etc., of cotyledons.

VIII. GENERAL OBSERVATIONS.—Observe *how plants behave;* how they climb or twine; if they sleep at night; if they have regular times for unfolding the blossom (as the "four-

o'clock"). Observe changes in the color and attitude of leaves due to meteorological phenomena. In what kind of soil does the plant thrive? Are its roots sent deep into the ground? Compare the stability of the plant with the number and relative size of its roots. What insects frequent the plant? What insects visit it? What birds visit it? For what?

Keep a record of daily observations of some one plant or plants throughout the season, so that you can write a life history of that plant. Make collections of stems, buds, fruit, seeds, etc., for winter study. Prepare sections of common trees—showing bark and rings—to be mounted for school-room observation and comparison.

NOTE.—The above is intended to be *suggestive* rather than exhaustive, and has been prepared with special reference to those investigations within the reach of every district school.

MIGRATION OF BIRDS.

The *Science Supplement* of February 26, probably first called the attention of many teachers to the wide-spread "Destruction of our native birds." The appalling statistics therein given must awaken in every thoughtful spirit an ardent desire to protect the hapless-winged creatures whose slaughter is a disgrace to our civilization. Every teacher must desire to lead the children under her care to know and love their "winged brothers," to recognize their voices, to watch them as they build their nests and rear their young, to welcome them as they return from their southern home, and to bid them farewell as they speed away on their journey southward from the cold winds of our northern winter.

She must do more. She must lead them to see that the wanton destruction of bird life means crops wasted by insect enemies, human beings suffering because of this loss, the whole country poorer because of thoughtlessness and vanity. Only by study of birds and bird-ways can this be done.

DIRECTIONS TO STUDENTS.

In addition to the points given in the circular on the "Geographical Distribution and Migration of North American Birds" for 1886, which can be obtained from the U. S. Department of Agriculture at Washington, D. C., the following more detailed observations are suggested:

1. FLIGHT.—Observe whether the bird flies habitually (*a*) near the ground, either in open spaces or among shrubs and underbrush; (*b*) among branches of trees; (*c*) high in the air over open prairie or swamp.

Does the bird fly most in the early morning, at noon, in the evening, or during the night? How does it fly? With long, sweeping motion of wings, or short, sharp movement, or soaring motion? Many birds can be identified by their mode of flight, when so far away as to not be otherwise distinguishable.

What is the relation of the weight of the bird to the extent of wing surface and the rapidity of wing stroke?

2. FOOD.—What is the usual food of the bird observed? Where is it obtained? Among grasses and weeds, among branches of trees and shrubs, in the open air high above the ground, etc., etc. How is the food obtained? By probing with the bill, by tearing apart of seed-vessels, etc. When is the food obtained? Early in the morning, in the dusk of twilight? Does the same bird feed upon insects and seeds and fruits? What proportion of his food is insects? "Table manners"?

3. NEST.—Describe the nest, the material of which it is constructed, the mode of construction, etc., its size, color, shape.

Is the nest made on the ground, in shrubs, in trees, in grassy hummocks? How is the nest concealed?

When is the nest made? How long a time is required for making? Do both the male and female birds make it? For how many broods is the nest used? Does any species of birds show decided preference for certain trees or shrubs as nesting places?

4. BREEDING.—When does the bird mate? How many egg are laid? What is their size, their color, etc.? When are the eggs hatched? When do the fledglings leave the nest? How many broods are raised in a season? Do both parent birds feed the young? Are fledglings taught to fly by the parent birds?

5. SONG.—Do different species of birds have any preference for special time of day for singing, or are they heard at all times? Is the song imitative? Does the bird sing when perching, or when on the wing, or at both times? Is there any marked variations in the songs or calls of the same bird at different times, or for different purposes? Example—Notes of warning, notes expressive of surprise, joy, etc.

It is suggested that in each school a daily record be kept of

observations made in the directions indicated in these papers upon plants, birds, and the weather, and that the teacher observe whether there is any mental or moral development in her pupils which can be traced to the stimulus of these investigations.

WEATHER OBSERVATIONS.

BY G. W. FITZ—COOK COUNTY NORMAL SCHOOL.

OBSERVE. 1.—Whether clear weather is relatively warm or cold.

2.—Whether fair weather is relatively warm or cold.

3.—Whether cloudy weather is relatively warm or cold.

4.—Whether rainy weather is relatively warm or cold.

NOTE. Test temperature by a thermometer which is kept dry and yet freely exposed to the air in the shade.

5.—Which are apt to be stormy, warm, or cold spring days?

6.—Does the direction of the wind affect this?

7.—Observe carefully the formation (development) of clouds and their dissipation. In the sudden showers whence comes the clouds, and what causes their disappearance?

8.—Whence comes rain? Clouds? Moisture in air, etc.?

NOTE. Keep in mind the action of heat and gravity and all will be clear. Heat causes repulsion of particles, thus overcoming cohesion and giving rise to expansion. Heat causes evaporation (What is it?) and expansion; gravity pushes the moisture and air up;—heat is lost by (*a*) radiation, (*b*) expansion under lessened pressure (1 degree F. to 182 ft. ascent, etc.) (*c*)——?

Loss of heat results in condensation (What is it?) of watery vapor to "water dust." (Tyndall: See "Forms of Water" and "Heat as a Mode of Motion.") Motion of the particles (falling, etc.) causes them to touch, coalesce, fall more rapidly, and become full-sized rain-drops.

9.—What is the lowest temperature at which it rains? Highest at which it snows?

10.—What are the conditions which cause snow? How is the snow-flake builded? By what?

11.—When does it hail, winter or summer? Why? See Davis on "Whirlwinds, Cyclones, and Tornadoes."

12.—Make barometer and observe changes in heights;—compare with thermometer, dew-point, etc.—weather conditions, etc.

13.—Tie thin cloth on the bulb of a thermometer, moisten it and compare readings with those of "dry bulb" thermometer. Note that differences are variable—greatest in dry weather, least in wet weather. Why?

14.—Observe when dew is deposited on cold objects. Measure the temperature of an object which will just cause dew to appear on its surface (a tin cup containing water and cooled gradually with ice until dew appears on the bright surfare; temperature tested with a thermometer which may be used to stir the water.) Find temperature of "Dew Point" at different times.

15.—Study carefully the weather reports in daily papers, etc. *Remember*, Heat is a force. Heat and gravity give rise to weather and climate,—do all the work. Cold is a sensation—not a force, and does nothing. The teacher must not lead pupils to *theoretical* conclusions about weather, till he has some basis for them. Weather is a complex problem, and should not be taught as a simple one. Children should be led to observe the weather from day to day, and to think of the varying phenomena as produced by ascertainable causes, which causes are forces modified in action by varying conditions, yet acting invariably according to certain laws, which may be discovered by careful observation. Little of the weather may be understood except by the study of the larger weather conditions presented by the Signal Service in their tri-daily reports from stations scattered over the United States and Canada, also in Europe.

THE STUDY OF GEOGRAPHY.

BY HERDER, [1744-1803.]

[Translated by Dr. John B. Daish, John Hopkins University. Published in Education, January, 1888. With permission of translator.]

"It would be fruitless by a long speech on this occasion as the better business of the day to show the young people in their strife of industry and glory, or to take their precious time; and still it would be more fruitless to lose this time in a Latin speech, which would be understood by only half of this assembly, or none at all, and it is by those very ones I wish to be understood. I have,

therefore, decided to speak of the suitableness, usefulness, and necessity of a science to be taught in schools; of this subject I heard two years ago in this Imperial Gymnasium the striking expression that it is a dry study. In many examinations in this subject, which it has been my duty to hold, I have found more of the youth strangers to it than I would wish. The science is none other than geography—a study which, according to my conception, is just as dry as if I should call the Ilm, or the great ocean dry, since I know few sciences so rich in necessary and pleasant facts of knowledge, yet at the same time so necessary for our time, and would be so fitted for the youth that I wonder how any noble, well-educated youth in the best years of his life should not love the science before all others, as soon as it appears in the form in which it must appear—that is to say as the basis and auxiliary science of all studies which we most prize and value. Permit me, therefore, most learned assembly, that I give you a little of the material and of the method which I, in the best years of my life, learned with the greatest pleasure, and have taught with equally as much pleasure to others. I speak from experience; the matter will speak for itself.

"Certainly if one understands by geography nothing but a list of the names of countries, rivers, boundaries, and cities, then of course it is dry; but also at the same time a list of words so badly treated and misunderstood, as if one knew of history nothing but a list of unworthy kings and dates. Such a study is not educating, but is in the highest degree frightening, and lacks sap and strength. Also a great part of political geography, as well as political history, has no charm for the young; indeed, if one should speak the truth, not once wholly understood, since of the greater part of the actions of States which have been carried out the young have so little a right conception that at most they are wanting to grown people. But is this true geography? true history? Is a miserable nomenclature a speech? Does the learning by heart of a vocabulary constitute a good author, and would we not consider one as insane who, in order to learn Latin and Greek, would study nothing but a lexicon? Exactly is this the case with geography and history if one uses them merely as an index of rivers, countries, cities, kings, battles, and treaties of peace. All these are necessary material, but the building must be built out of them, else they are but stone and lime, that is, ruins, in which

no one rejoices and which is inhabited by no living soul. The colors are necessary to the painter; he uses them in his works of art, and then only do they delight the eye and educate the soul. Let us see what the word geography can say according to its name.

"It is a *description of the earth*, as far as it is a knowledge of the earth is physical geography the most necessary; a knowledge as important as it is easily and pleasantly entertaining. Who would not wish to learn of the wonderful house in which we live? To learn about the earth, a globe, as a planet; to make known the common laws according to which it revolves around the sun and on its axis, and by that means days, years, climates, and zones come into being; to bring all this into the foreground, with all the comprehensiveness and dignity which it demands,—if that does not elevate and actuate the mind, what does? It gives to a noble youth a share of that sublime joy which we feel if we read the dream of Scipio as given by Cicero, or hear elevating music; for this knowledge is the true music of the soul. Out of the great unity of natural principles an unmeasured row of geographical consequences is visible; these we daily feel and enjoy, and of them every one who is capable of understanding wishes an explanation. So I have a poor opinion of a young man who, for instance, should read without pleasure Fontenelle's Speech of More than One World; so he must be a statue with human appearance who remains undisturbed by the great laws which rule on our earth and by which he becomes what he is. All during my life will the times of my youth remain a pleasant dream since my soul first received this knowledge and I was charmed over the border of my native country out into the wide world of God in which our earth floats.

"The planet which we inhabit is divided into earth and water; the former stands out like a mountain, at both sides of which, as on inclined planes, streams flow; this is the great receptacle of water out of whose mists, purified by the air and drawn up to the peaks of mountains, becomes the source of all fruitfulness and nourishment. What a fulness of beautiful and useful knowledge rests in this conception! If the youth in his thoughts ascends the high mountain ridges and learns to recognize their peculiar phenomena, if he afterwards wanders down with the rivers into the valley and finally comes to the seashore and becomes accquainted with other creatures, with minerals, plants, animals, and men; if

he learns to know that that which was mere chaos in the form of the earth has also law and rule, and also how, according to these and to the laws of climate, forms, colors, ways of living, customs, and religion change and are changed, and that, despite all differences, mankind is everywhere but a race of brothers, created by One, sprung from a common parent, striving and struggling after *one* goal of happiness, but in various ways,—oh, how elevated will his sight be and how his soul will expand! Meantime he learns the various products of the earth, the many different ways of thinking, uses, the ways his brothers live, and of mankind, who enjoy the light of one sun and obey the same laws of fortune. Truly, then, geography must be the most charming picture, full of art, plans, change; indeed, full of prudence, humanity, and religion. He changes himself, without leaving his fatherland, to an Ulysses, travels through the earth, finds out about people, countries, and customs, full of prudence and folly. And if all these are made vivid, then it must be a stupid monster who by that means does not receive into his head ideas, and into his heart a great and refined perception. Oh, had many short-sighted, proud, intolerant barbarians who imagine that their corner is the only salvation, and that the sun of reason shines only in their den, only learned geography and history better in their youth, it would have been impossible for them to have made the narrow band of their heads a measure of the world, and made the customs of their corner the rule and guide of all times, climates, and peoples! For my part, at least, I must confess that geography and history (both considered in the true circumference of their conception) have first of all contributed to the shaking off of a line of lazy judgments, to the comparing of men and customs, and to the seeking out of the true, beautiful, and necessary in which form it shows itself from the outside. In this way geography and history serve the most useful philosophy of the earth, namely: the philosophy of customs, sciences, and arts; they sharpen the *sensum humanititis* in all forms and shapes; they teach us with enlightened eyes to see and value our judgments without despising on that account any nation of the earth. 'For in Him we live, and move, and have our being,' said Paul before the altar of the unknown God of the Athenians, 'and hath made of one blood all nations of men for to dwell on all the face of the earth, and hath determined the times before appointed, and the bounds of their habitations.'

"It follows, then, from what I have said, that geography made in a real way manifold, rich, and vivid is inseparable from natural history and the history of peoples, and furnishes for both the base-line. Natural history is that which most charms the youth and fills his head with the richest, purest, truest, most useful pictures and ideas which neither the *Apthoniac Chrin* nor logic and metaphysics can give, and the truest, most pleasant, and useful geography for children is natural history. The elephant, the tiger, the crocodile, and whale interest a boy far more than the eight electors of the Holy Roman Empire in their ermine mantles and furs. The great revolutions of the earth and of the sea, the volcanoes, the tide, the trade winds, and similar facts are far better suited to his years and powers than the pedantry at Regensburg and Wetzlar. By means of natural history every country, every sea, every island, every phase of climate, and every race of mankind, every division of the world, portray themselves in him with undying characters; so much the more as these characters are constant and do not change with the names of mortal regents. The Egyptian horse, the Arabic camel, the Indian elephant, the African lion, the American crocodile, and the like are symbols and coat-of-arms of individual countries more worthy to be remembered than the changing boundaries which follow a delusive peace, or perhaps the first new war may alter. Since all the riches of nature are so near related, since the chain of all earthly beings is so interpendent, one is a remainder of the other. The mountains remind one of the metals and minerals of springs and streams, of the effect of the atmosphere as well as of animals and men who inhabit it or its sides. All unites itself to another and gives to the mind of the youth to be educated an indelible picture full of traits rich in lessons, which traits pass over into all sciences and everywhere are of manifold and valuable use.

"Every one knows that geography serves history, and indeed, that history, political and technical, of the Church and State; indeed, I may say that history without geography, as also without chronology, for the great part becomes a true air-castle. What does it help a young person if he knows what has happened and not knowing where it has happened? And why so often is ancient history rather called an unsteady dream than true history? Is it not, among other things, because it is too often separated from ancient geography and therefore speaks from passing of mere

shadows which hover in the air? History becomes, so to say, an illuminated map for the powers of imagination, and even of judgment by means of geography; for only through its help is it perceptible why this and no other people have played a certain and no other role on the stage of the world; why these rulers here and those there could rule; why this empire must exist a long, and that one for a short, time; why the monarchies and empires follow each other in this way and in no other, have only such borders, quarrel, or are united; why science, culture, inventions, and art take this and no other course; and how from the heights of Asia through Assyrians, Persians, Egyptians, Greeks, Romans, Arabians, Europeans, finally the ball of the world-wide events and strifes is rolled now hither and now thither,—I would have to speak for hours if I wished to show all this in needed examples. In short, geography is the basis of history, and history is nothing but the geography of times and peoples set in motion. Whoever studies one without the other understands neither, and whoever despises both should live like the mole, not on, but under, the earth. All the sciences which our century value, esteems, demands, and affords are based especially on philosophy and history; trade and politics, economy and law, medicine and all practical knowledge and manipulation, are based on geography and history. They are the stage and the book of God's household. History the book and geography the stage. A student must remain back in every science of the academy if he does not bring with him from schools these foundation sciences, geography, history, and natural history, almost the material for all. Fortunate that one who saw them in his school time in a beautiful and charming form! Fortunate that one whose memory is not filled by their entertainment, but whose soul is educated and mind unlocked! Up, noble youths, and show what I only in common pictures and incomplete and from a distance could point out by individual trials in deeds and practice. Frighten us by your industry, your noble watchfulness, your noble desire for glory in this and in all other sciences of your life, and the genius of your life will crown your laudable, early begun work."

RELIEF MAPS AND THEIR CONSTRUCTION.

BY JOHN BRION, CONSTRUCTOR OF RELIEVO MAPS TO H. R. H., THE LATE PRINCE CONSORT, FROM "AMATEUR WORK."

It is generally conceded that the most natural and effective mode of representing objects is by truthful modeling. Paintings and drawings, however ably executed, can not give, at one view, complete transcripts of the things represented. To nothing does this apply with more force than to geographical subjects.

I think every one will admit that it is impossible to imagine elevations and all varieties of peaks, ridges, water-partings, and table-lands with any degree of accuracy upon the flat surface of a map. The most elaborate hill shadings only indicate positions and areas; natural forms and altitudes remain unrepresented except in these vague points; light shading indicates moderate elevations and heavy shading represents higher ones.

The late A. Keith Johnston was so strongly impressed with the futility of hill shading that in many of his finest works he abandoned it, substituting black lines to mark the positions and directions of elevated tracks, and his plan has been frequently adopted by others. But the method, although it frees a map from much confusion, fails to give the slightest indication of form or hight. So entirely has the superiority of molding over all other forms of geographical representation been admitted that many clever attempts to give the effect of relievo work have been made, by what is called photo relievo or panaramic maps; but in all of these there are, of a necessity, grave errors in perspective, to say nothing of the futility of endeavoring to present by those methods an "all around" view of a hilly or mountainous region.

It will perhaps be said: If the superiority of relief maps over all others be so great, why have they not been admitted to more general use? The answer is easy: On account of their cost. A good quarto map of Switzerland can be had for two shillings, while Killer's admirable re-

lief of the same costs as many guineas. I can vouch for the fact that where it has been found practicable to issue a relief map at a moderate price, the sale has been speedy and extensive.

To obviate the serious objection of price, and to enable any one who is desirous of so doing to acquire and embody exact ideas of any carefully explored portions of the earth's surface, is the object of this paper. It will be found easy and inexpensive, and will gratify the student with a new sense of creative power, expand the mind, fix more deeply the present knowledge, and correct wrong impressions of structure.

Relievo work may be divided into two classes, maps and models. As the maps are embossed from the latter, accuracy in their construction is all important, and with them we will begin.

Assume that we are to construct a relief map of England; we will first procure two simple, well engraved, uncolored, unmounted maps of the size which we wish to make. Procure a well-seasoned and smoothly-planed board 1½ inch wider all round than our map. Next make a moderately thick paste of corn flour ½ lb, and one teaspoonful of powdered alum, mix carefully with cold water to the consistency of cream. Boil for three or four minutes, stirring constantly.

The board and paste being ready, soak one map and one sheet of cartridge or brown paper of the same size as the map in clear, cold water, till they are saturated. Take care that they lie perfectly flat. (*Note.*—Paper of a soft, fine texture, not very stout, is best for this work.) Remove the map and paper from the bath, and carefully lay them on a piece of white calico in order that it may absorb all superfluous moisture. Let them remain to expand about ten minutes. With your paste-brush work the paste well into the back of the board and upon one side of the blank sheet of paper, mount the paper on the back of the board. (Be careful not to leave much paste upon the paper, but work well into the pores.) Mount the map upon the front of the board; it is a good plan to place a sheet of blank paper over the map, and with a

round rule work evenly over the surface. The mounting done, leave the work to dry, but avoid placing the board in the sun or near to a fire. The reason for using the paper at the back of the mounting board is to compensate the warping that would otherwise arise from the contraction of the map in drying. The motive for mounting the map in a thoroughly expanded state is all important in the process, for if it were mounted dry, the wet maps would, by expansion, be too large for the die when prepared for embossing. The time for drying the map after mounting depends on the weather and the warmth of the room in which it is placed. Twenty-four hours are generally necessary, as it is unadvisable to commence modeling till the map is quite dry. This being done, the next step is to determine and permanently mark the positions and altitudes of the chief hills, mountains, etc.

The question of the relative proportions that should be observed between the vertical and horizontal scales has been much discussed. The true, natural scales for relievo work are those which are admitted to represent vertical objects in their *apparent* and *remembered* proportions. To obtain these the following rules are good, general guides: On a map of six inches to one mile, or greater, an equal vertical scale will produce a natural representation, unless the locality is very low, in which case an increase in the vertical measurements of $\frac{1}{8}$ to $\frac{1}{2}$ times will be necessary.

On	map	4 ins. to 1 mile	increase	vertical	scale		$\frac{1}{8}$	times.
"	"	3	"	"	"	"	$\frac{1}{3}$	"
"	"	2	"	"	"	"	1	"
"	"	1	"	"	"	"	2	"
"	"	3 miles to one inch			"	"	3	"
"	"	6	"	"	"	"	4	"
"	"	12	"	"	"	"	8	"
"	"	24	"	"	"	"	16	"

The following directions will be acceptable to those who find difficulty in forming the scales for working purposes: Take the horizontal scale of the map to be embossed; for example, take a map of England and Wales, of 24 miles to an inch. This by the above table should have a vertical scale 16 times greater than the horizontal.

Measure off an inch upon paper, divide into 24 parts, each representing a mile, or 5,280 feet. Let off sixteen of these parts on a line, and from it cut 1-20th part. Divide the remainder of the line into five equal portions and each will represent 1000 feet vertical, sixteen times in excess of the horizontal. The question of scales is very important in this work, but there is also a great necessity for comparing, whenever practicable, the model while in progress with the objects sought to be represented.

Having marked the vertical scale upon a piece of cardboard, boxwood, or ivory, and being provided with rivets, or fine brads, 1½ inches to ½ inch in length, drive these rivets perpendicularly into the board on the places marked to denote the different summits, measuring the feet by your graduated vertical scale.

There are various substances in which the modeling can be executed: China, clay, pipe-clay, papier-mache, and white composition. To prepare papier-mache for modeling: Take white blotting-paper, and soak it in water till it is reduced to pulp; squeeze dry in a cloth, mix thoroughly with the white paste described, working it with a knife on a board or stone slab, till of the consistency of painters' putty. For white composition modeling clay: Take best whiting, add one third, by measure, of common wheat flour, mix with cold water, and work to a stiff, doughy consistence. With any of these modeling clays proceed to work upon bases of the hills shaded upon the mounted map. A knowledge of geology is not indispensable to the construction of relievo maps, and an acquaintance with the general contours of the geological formations, will aid considerably in producing truthful modeling. In addition to this obtain, whenever practicable, photographs or reliable sketches or engravings of remarkable localities; and if the modeler can sketch, he will soon after he commences the practice of the art, be often busy in jotting down the outlines of hills, etc., that meet his eye. The tools necessary in geographical modeling are simple: An ordinary paper-knife, and modeling points, stumps or flats, and scrapers made of bone pen-holders, filed or glass-

papered into shape; these will enable the worker to produce almost any kind of form and delicacy of finish.

To begin the modeling: Work a little size or gum-arabic over the whole of the mounted map, and when dry build up with your clay the principle height marked by the rivet; then run a narrow piece of modeling clay along the remainder of the range, gradually throwing off the edges of the clay where the fainter shading indicates the lower elevations. Make the ridges of your hills irregular, and none so high as the first point. Tool out the valleys in the hill-sides till a contour of this appearance is produced. A good general contour is what should be first sought for, details and high finish will then be easily obtained. Build the clay in cones upon the parts marked by rivets, keeping each point quite distinct from the others, and leaving the valleys to be filled in after the modeling has become tolerably dry. It is often of great advantage, when constructing a map on a small scale, to refer to one of much larger size, as features are there frequently represented which throw great light upon the smaller work. It is necessary in all cases to adhere strictly to the areas marked by the hill shading of the map you are modeling upon, and to take especial care not to obliterate or confuse the river courses, or, when the process of embossing is effected, you will be presented with the phenomena of rivers running up or over hills, etc. Frequent reference to your unmounted map will save much after-trouble in corrections. On no account lose sight of the heights marked by the nails as the summits of the hills by modeling over them. The great charm of a model or of a relievo map is its close resemblance to nature; hence distinctive features, as well as general correctness, ought to enter as much into the work of the modeler as facial contours and expression do in work of the portrait painter. Suppose the principal heights on the map to be modeled, it will be well to leave the work for a day or two to get well set. A very little practice will enable anyone to determine when the modeling clay may be touched without disturbing the work already done. The secondary modeling consists in the lesser elevations. This will lead to the third modeling in which

we add the minor spurs of the principal hills, level up the land and beds of the river gradually toward the salient heights, which have hitherto appeared as sharp abrupt landmarks upon a dead level. This portion of the work is apparently easy, but it requires taste and judgment to distinguish between the leaving of the model abrupt and unnatural (as will be the case if the valleys and uplands are not filled in and made to blend with the bases of the hills and mountains), and the obscuring of the work by filling in the lowlands too heavily. Avoid rendering the work blunt and indefinite, on the one hand, or "patchy and poor" by neglecting the natural lie of the slopes and depressions, on the other. In working up the valleys, it will be found convenient to roll out a piece of clay half the width of the depression, and with a modeling tool to gently spread this till it reaches the hill sides, and is made to blend with the first portion of the work; the sides and bed of the valley will then naturally follow. At this stage take care not to obliterate or mistake the river beds, and by reference to your unmounted map, and occasional use of the compasses, keep the water-courses true. The cliffs aud coast-line generally may be now laid on. Do this by rolling out a long sinuous piece of clay, and running it about a quarter of an inch from the coast. A gentle pressure of the fingers upon the top will flatten it and make it approach the line of coast. Work on this by vertical strokes of your modeling points, and you will obtain the distinctive features of the cliffs. Smooth your clay gently down seaward, where there are no cliffs, and blend it in with the undulations of the land beyond. While working up to this point, the model should be frequently brought to the level of the eye, and the contours rigidly examined on all sides. By this view errors are oftimes detected and new ideas frequently suggested by the horizontal survey. During the process it will be found necessary to moisten the clay already modeled before adding new clay. This should be done by passing cold water gently over the dry surface. The modeling clay when not in use should be kept in a damp cloth. The touches in modeling are so infinitely varied and depend so much on the taste and judgment that

directions must be general. Strive to be natural, accustom yourself to look upon nature as the best tutor, and imitate her features as nearly as possible. The most gifted artist can only approach her very humbly, but he who seeks her frequent guidance can never entirely fail. Be sure in the final examination of your work, that there is no under-cutting or miniature covers, produced by too great roughness of work or porosity of the clay. The model completed, obtain a die or matrix for the purpose of embossing. Dies for embossing paper work are generally formed of metal, cast, electrotyped or engraved. If metal casting is to be used, the map to be embossed must be drawn to fit after the cast is obtained; the contraction which the molten metal undergoes in cooling would throw everything out of register. Electrotyped dies are entirely free from this objection, and are to be preferred to all others. In order to prepare the model for casting, dissolve white wax or beeswax in turpentine or other spirit in such proportions as to produce a thick creamy consistence. Warm the bottle containing this, also the model, very slightly. With a soft hog-hair pencil brush over every portion of the model. The clay will absorb much of the wax. Let it stand a few minutes to cool; warm wax and model again, and brush all over a second time, carrying the dissolved wax over the whole surface of the map, even where it has not been modeled up, namely, the seas, bays etc. Be careful not to miss a point. Let the model cool again, then examine whether the wax has stopped any of the fine cuttings in the work; if so, pass it to and fro at a little distance from the fire till the superfluous wax is absorbed. Let all remain to cool, and while this is going on prepare for casting by taking four pieces of narrow thin wood of lengths to form a raised frame around the model. Tack the slips to the edges of the modeling board, so as to enclose the model in a kind of shallow box. Be especially careful that this is of sufficient height to admit of plaster of Paris being cast to a depth of three inches for a model of eighteen inches square, adding one half inch in depth of plaster for every six inches addtional in length or breadth of modeled work. The slips of

wood being securely tacked on, stop the corners with clay to prevent leakage, brush the wood and model carefully over with olive oil. It is now ready for casting. In a large basin or other convenient vessel, put luke-warm water, that has been previously boiled, to this add the dry plaster, scattering it gently over the surface with one hand, and briskly by mixing it with the other, till the mass becomes of the consistence of thick cream. Shut all doors and windows to prevent draughts, and pour the liquid plaster steadily and continuously over the oiled surface of the model, shaking it gently for the first minute, in order that the plaster may enter the minutest parts of the work. Cover to a depth of about one and a half inches. Allow ten minutes to elapse, when a second quantity of plaster can be mixed, and the mould filled in to the required depth. When it is completely set, scrape the back to a level. In about a quarter of an hour, remove the wooden slips from the model, and let it remain for an hour longer, taking care meantime, to free the sides from any plaster that may have run between the side slips and the model. Before the expiration of an hour, the model and casting will begin to separate at the edges, but do not be hasty in attempting to lift your work. When about to do so it is well to turn the cast over on its back, so as to bring the model upwards. If the modeling, waxing, and oiling have been properly done, the mould may now be lifted from the cast without difficulty or fracture, but if there be signs of adhesion between the two, let them remain longer. If it should be found that some portions of the model have adhered to the cast, do not hasten to detach them. If the waxing has been thorough they will soon detach themselves so far that they may be easily removed with the help of the modeling tools, and put in their proper places on the model. Strong size or thin glue can be used as a cement. The plaster die being thus separated, let it remain on edge so as to allow the air to circulate around it for twenty-four hours. It should then be closely examined in order to ascertain whether air bubbles appear in any part ; if you discover any stop them in thus : Mix a little fine plaster in a cup as for casting, scratch the bubble-

hole deep with a modeling point, wet it with cold water, applied with a camel-hair pencil, and with the same paint in the defect with the liquid plaster. The die being of considerable thickness will require several days to become thoroughly dry ; do not be mistaken in supposing that the cast is dry because the surface appears so, a clear ring from the cast when struck by the knuckles is the best indication of thorough dryness. If you wish for a cast metal matrix, simply take your plaster die to a good founder instructing him to keep the metal cast as thin as he conveniently can for the purpose of saving weight and cost. Should you decide to have your die electrotyped test the accuracy of your modeling before embodying it in metal. Place the unmounted map with its face against a glass window, and trace with lead pencil upon the back the hights and certain other places which will serve as register points for the whole map. Run a blunt penknife along the hill shading, working the summits of the ranges and all the highest points, but do not cut through the map. Then work the map in cold water, taking care not to obliterate the penciled markings. When saturated, dry off superfluous moisture with a soft cloth, lay the map carefully on the plaster die so as to fit the coast-line. Fit the map to the penciled register marks. Secure the map in its place by pasting long slips of paper on the sides of the map and the sides of the die. Paste the back of your map evenly and thoroughly ; then rub with your fingers, gently along coasts low lands and small elevations, and proceed gradually till you reach the greatest heights, or rather the greatest depths of the die. Cautiously break the portions which have been partly severed and lay the divided parts in their natural position east, and west, or north and south as the case may be. Press them firmly into the die and cover the fractures with narrow pieces of soft white paper, *torn not cut*, at the edges. Paste these slightly before laying them on, and with a modeling tool, judiciously used to prevent breakage, sink them into the depths of the die that remain exposed by fractures made by cuttings in the map. Go over the whole again with paste brush and fingers. With pieces of very stiff model-

ing clay, properly formed, press firmly down into every part. Fill in the land evenly everywhere with the clay, smoothing the work off exactly to the coast, and bring all to a perfect level. Paste over the whole. Take a mill board or panel of smooth wood; paste this also and lay it upon your embossed map, rubbing it firmly on the back in order to attach the two. Cut away the slips that have secured the sides of your map to the die, get an assistant to raise the die gently on one edge to about the angle of forty-five degrees, holding the mounting board firmly to the embossed map yourself. Gently lift the work from the mould, taking care not to allow the tops of the hills to touch anything. If errors are discovered they can now be rectified by cutting away portions of the die, where required, or by filling in with liquid plaster and your pencil. Proofs of corrections may be taken on plain wet paper and modeling clay. The plaster die completed, another step must be taken to prepare for the electrotypist. Warm the die before a slow, clear fire, then with a spoon pour melted beeswax over every portion of the die. The plaster, being well warmed, will absorb a considerable portion of the wax; the residue will disappear on the die being held before the fire. Repeat the waxing a second time, which, completely cooled, brush olive oil over every part; edge it around with wooden strips, and take a cast in fine plaster according to previous directions. This cast need be but one and a half inches thick. Let the cast remain the same time as previously recommended, then take it from the die. This relief cast is prepared for the electrotypist as follows:—1st, dry it thoroughly; 2nd, boil it in beeswax, over a slow clear fire; 3rd, when cool, clear every bit of wax from the surface by holding the cast before a moderate fire; 4th, with a soft brush go gently and carefully over the whole of the sea and relievo portions, with the best black lead in dry powder. The model is now ready for electrotyping. Electro dyes are made of various thicknesses, from that of a six pence to one-eighth of an inch. The time required varies from four to five days to a fortnight. After the electro is taken from the bath it is "backed up" with lead. This is done by laying the elec-

tro face downwards, on a hot iron plate, well-secured around with a metal edge, same as wooden edge used in casting plaster. Soft solder is then worked over the whole of the back, and upon this, by repeated, judicious pourings of molten lead, a solid even block is formed, which protects the die and fits it for being embossed from. The method for Parian dies is as follows:—Prepare the relief plaster cast by waxing as before. Make wooden edges four inches in height. Oil model and inside of wood carefully. Be sure all corners are completely stopped, and every space between wood and cast. Take fine plaster of Paris; to every quart of this add a dessert spoonful of alum, in powder; mix thoroughly, then with luke-warm water, asbefore, prepare your plaster for casting. Have sufficient to cover mountains at first cast. When set, back it up by a second casting in coarse plaster, total thickness about four inches.

When firmly set, scrape back off to level. Proceed as recommended on taking first die from original model. When ready, remove die from relievo, and when perfectly dry, the die will be hard as marble. For casting, wax surface as for the plaster one. Very little wax will be required, as Parian is much less porous than plaster. The Parian cement being ready, what is technically known as a "*force*" must be obtained.

Gutta-percha is good for this purpose. Procure a sufficient quantity of the ordinary kind. Three-eighths of an inch is convenient thickness. Cut your gutta percha into pieces three or four inches square, put in boiling water. Let them remain, stirring occasionally, till completely softened. When this is done, place the mass on a board or table well wetted with cold water, and when it can be handled, knead the whole into a compact mass. Frequently wet the hands in cold water to prevent adhesion. When about half cold, and getting a little stiff, but can be easily worked, roll into a cake about three-fourths size of the surface of the die. Rub a piece of soap over the gutta percha, then lay it carefully soaped face downwards, upon middle of the die. Quickly, with fingers, press it firmly into all depressions, taking care not to move the gutta percha to and fro. Roll the back off level,

and smoothly spread the gutta percha beyond the extent of the land. It will soon cool. It is a good plan to lay one of your casts back downwards upon it while setting, to prevent warping. When perfectly cold it may be lifted with ease. From half an hour to an hour, according to thickness, is usually sufficient. If all has not gone well, cut up your gutta percha, boil it again and persevere till you succeed. Success in this depends on using the gutta at the right time, *i. e.,* when about half cold, but not so much as to be refractory in working.

The next step is that of embossing. Trace and properly soap the maps to be embossed as previously directed: lay upon a table a piece of thick felt or carpet, doubled so as to form an even bed. Upon this, place your die, face upwards. With powdered starch, in a muslin bag, lightly dust both its plane surface and its depressions. Lay a wet map, half cut through at the highest elevations with your blunt pen knife, and cleared of all surface moisture, accurately upon the register points of the die, as already described, secure it by the paper slips at the edges. Dob the smallest depressions firmly down with a piece of wet cloth formed into a convienent ball. Lay the fractures along the lines of the deepest depressions of the map carefully in their places, and repair them with white paper in the same manner as you did in taking the first proof. Smooth all down neatly. Pass the paste brush lightly but thoroughly over the entire map, and upon it smoothly mount a damp sheet of demy paper, previously pasted. Press this into the depressions; then take your gutta-percha "force," powder it well with the starch, to prevent it sticking to the map, and fit it to its proper position on the die. A couple of points will enable you to do this securely. Press the "force" firmly down upon the map. Rub a piece of soap over the back of the "force" and with the face of an auctioneer's hammer, or a porcelain knobbed door-handle, rub with considerable power over the whole of the back of the "force," crossing and recrossing the rubber in every direction, so that every portion of the map beneath may receive the impression of the die and force. Be careful not to *strike* the die; it will bear very

considerable exertion of strength when *rubbed*, but would go to pieces under a moderate blow, or beneath a press. The best method of obtaining power in rubbing is to firmly grasp the handle of your hammer or door-knob, and bring your hand in that position near your chest, throwing back your elbow, and rubbing "straight from the shoulders." Take especial care that your die always lies on a thick and even pad of felt or carpet. Remove the force cautiously. Examine the impression made upon the back of the embossed map. If not satisfactory, give what is termed a "second blocking." For securing solidity of work it is well to fill in the embossing solid with papier-mache. Embossed maps are mounted in three ways: 1st. upon thin panels of wood; 2nd. upon mill-board; 3rd. upon canvass "strained upon a stretcher." No. three is cheaper and easier to work, and ensures the perfect level so necessary to the correctness of relievo work. To mount the embossed map, paste the face of the canvas thoroughly, also the back of the embossed work. With care lay two corners of the mounted stretchers upon two corners of the map, let it fall gently into its place upon the relievo, rub the back of the canvas well and evenly down upon the map so that every part may adhere, remove the side pieces of binding paper, raise the die, and gently lift the embossed map. The drying of an embossed map must not be hurried by placing if before a fire or in the hot sun. That will cause warping or shrinking. A moderately warm room is needed. The period required for drying varies according to the size of the masses of relievo work. For small maps, twenty-four hours may do, for large and bold subjects three or four days will be required. During the first twelve hours it is well to let the embossed work lie in a horizontal position, face upwards supported by a panel of wood to prevent the work from sinking. When set, the relievo may be stood on edge so as to allow its drying equally at the same time back and front. Should any fractures be perceptible after the relievo is thorougly dry, dust the map carefully and with a soft hog-hair, or flat camel-hair brush, wash it lightly over with patent or other clear size. In sizing take care not to let the liquid

settle down into pools amidst the hills, etc., and go very carefully in cross action over every portion of the sea as well as the land. Stand aside to dry. Should any fractures remain after this, take a small quantity of finely powdered white starch, mix it to a creamy paste with warm size (do not use gum arabic). Keep the starch cement liquid by placing over warm water, while working. Go over the fractures with a camel-hair pencil dipped in the liquid starch. When this is completed and all quite dry, proceed to color your relievo. The coloring done and dried, give the map a second coat of size of thinner consistency than the first, in a few hours a third coat, being particular not to miss a single point, otherwise the varnish which has to follow will penetrate, and create an ugly brown mark. The last operation is that of varnishing. This should be done in a warm room with doors and windows closed, or currents of air may cause the work to become ridgey. Warm the map and varnish slightly before a fire: take care that the former is perfectly dry and well dusted. Three coats of varnish are better than two thick ones, allowing twenty-four hours for drying each coat.

THE END.